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Project No. 3302 Permit No. 11656

SOURCE EVALUATION REPORT

Saint-Gobain Containers, Inc.
Seattle, Washington

Glass Melting Furnace No. 4
Total Chrome

August 4, 2009

Test Site:
Saint-Gobain Containers, Inc.
5801 East Marginal Way S.
Seattle, Washington 98134

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1. CERTIFICATION

1.1 Test Team Leader

I hereby certify that the test detailed in this report, to the best of my knowledge, was accomplished in conformance with applicable rules and good practices. The results submitted herein are accurate and true to the best of my knowledge.

Name: Paul T. Heffernan

Signature ____________ Date 9/4/09

1.2 Report Review

I hereby certify that I have reviewed this report and find it to be true and accurate, and in conformance with applicable rules and good practices, to the best of my knowledge.

Name: David Bagwell, QSTI

Signature ____________ Date 9/14/09

1.3 Report Review

I hereby certify that I have reviewed this report and find it to be true and accurate, and in conformance with applicable rules and good practices, to the best of my knowledge.

Name: Michael E. Wallace, PE

Signature ____________ Date 9/15/09

2. INTRODUCTION

2.1 Test Site: Saint-Gobain Containers, Inc.
5801 East Marginal Way S.
Seattle, Washington 98134

2.2 Mailing Address: 1509 S. Macedonia Avenue
P.O. Box 4200
Muncie, IN 47307-4200

2.3 Test Log:

Glass Furnace No. 4, Exhaust: Total Chrome

Test Date	Run No.	Test Time
August 4, 2009	1	09:16 – 11:28
"	2	11:43 – 13:49
"	3	14:06 – 16:15

Summary: Three valid 120-minute runs

2.4 Test Purpose: To demonstrate compliance with the National Emission Standard for Hazardous Air Pollutants for Glass Manufacturing Area Sources, 40 CFR Part 63, Subpart SSSSSS for affected sources.

2.5 Background Information: None

2.6 Participants:

Horizon Personnel:

Paul T. Heffernan, Team Leader
Neil A. Young, Field Technician
Michael E. Wallace, PE, Calculations and QA/QC
David Bagwell, QSTI, Report Review
Christopher D. Lovett, Technical Writer

Test Arranged by: Jayne Browning, Saint-Gobain Containers, Inc.

Observers:

Plant Personnel: Marlon Trigg, Saint-Gobain Containers, Inc.
Agency Personnel: Gerry Pade, PSCAA

Test Plan Sent to:

PSCAA: Gerry Pade
USEPA Region 10: Madonna Narvaez

3. SUMMARY OF RESULTS

3.1 Table of Results:

Table 1

Furnace No. 4 – Total Chrome Test Results

Test Date: August 4, 2009

Sampling Results	**Units**	**Run 1**	**Run 2**	**Run 3**	**Average**
Start Time		09:16	11:43	14:06	
End Time		11:28	13:49	16:15	
Sampling Time	minutes	120	120	120	120
Sampling Results					
Total Chrome					
Concentration	µg/dscm	374	368	372	371
Rate	lb/hr	0.022	0.023	0.022	0.022
Production-Based	lb/ton	0.0039	0.0041	0.0039	0.0040
Subpart SSSSSS Limit	lb/ton				0.02
Sample Volume	dscf	72.9	76.9	72.0	73.9
Sample Volume	dscm	2.1	2.2	2.0	2.1
Percent Isokinetic	%	97	89	95	94
Sample Weight, Total	µg	771	801	759	777
O_2	%	15.4	16.2	16.4	16.0
CO_2	%	4.3	4.1	3.4	3.9
Source Parameters					
Flow Rate (Actual)	acf/min	26,800	28,900	27,000	27,600
Flow Rate (Standard)	dscf/min	15,700	16,700	15,800	16,100
Temperature	°F	383	395	383	387
Moisture	%	6.8	6.5	6.7	6.7
Process/Production Data					
Glass Pull Rate	ton/hr	5.66	5.66	5.66	5.66

3.2 Discussion of Errors and Quality Assurance Procedures: This table is taken from a paper entitled "Significance of Errors in Stack Sampling Measurements," by R.T. Shigehara, W.F. Todd and W.S. Smith. It summarizes the maximum error expressed in percent, which may be introduced into the test procedures by equipment or instrument limitations.

Measurement	% Max Error
Stack Temperature Ts	1.4
Meter Temperature Tm	1.0
Stack Gauge Pressure Ps	0.42
Meter Gauge Pressure Pm	0.42
Atmospheric Pressure Patm	0.21
Dry Molecular Weight Md	0.42
Moisture Content Bws (Absolute)	1.1
Differential Pressure Head ΔP	10.0
Orifice Pressure Differential ΔH	5.0
Pitot Tube Coefficient Cp	2.4
Orifice Meter Coefficient Km	1.5
Diameter of Probe Nozzle Dn	0.80

3.2.1 Manual Methods: QA procedures outlined in the test methods were followed, including equipment specifications and operation, calibrations, sample recovery and handling, calculations and performance tolerances.

On-site quality control procedures include pre- and post-test leak checks on trains and pitot systems. If pre-test checks indicate problems, the system is fixed and rechecked before starting testing. If post-test leak checks are not acceptable, the test run is voided and the run is repeated. The results of the quantifiable QA checks for the test runs are on the Field Data sheets.

Horizon does semi-annual calibrations on pitots, thermocouples, and nozzles. Pitots are examined before and after each use to confirm that they are still aligned. Pitot systems are leak-checked before traverses begin, and after runs are completed (before any component disassembly). The results were within allowable tolerances. Prior to use, thermocouple systems are checked for ambient temperature before heaters are started or readings are taken. Problems with connections or polarity are obvious from these and readings as temperatures rise. Thermocouples are relatively permanent and rarely go out of calibration.

3.2.2 Tedlar Bag Gas Sampling and Analysis: The QA procedures from EPA Method 3/3A in Title 40 CFR Part 60, Appendix A, July, 2007 were followed for gas sampling and analysis. Analyzer system checks are noted on the Calibration Field Record sheet, with procedures documented in the QA/QC section of the Appendix. All calibration standards used in the testing were EPA Protocol 1 with the exception of ambient air that was used to span the oxygen analyzer. Gas certificates are in the Appendix.

4. SOURCE DESCRIPTION AND OPERATION

4.1 Process and Control Device Description and Operation:

There are four glass-melting furnaces at the site. Furnace No. 4 is an end-port regenerative furnace and is air-fuel fired, also utilizing natural gas as its primary fuel source. As a regenerative furnace, its increased fuel efficiency is realized by utilizing the heat generated in the combustion process to preheat the air and fuel used in further combustion processes. Additionally, increased thermal efficiency is realized by the regenerative furnace in providing heat to the primary glass-melting process itself.

Production records including raw materials, glass produced and fuel usage data are included in the Appendix

4.2 Test Ports: The exhaust duct of Furnace No. 4 is tapered at an angle of 5°. However, the duct can be considered straight for the purpose of meeting EPA Method 1 criteria as discussed in the EPA document, "Guidelines for Sampling in Tapered Stacks," by T.J. Logan and R.T. Shigehara (1978). According to this document, if the angle of the stack wall taper is less than 15° the duct is to be considered straight. The duct was sampled using the maximum number of traverse points indicated in EPA Method 1, 11.2.2, Figure 1-1.

4.2.1 Test Duct Characteristics:
Construction: Steel
Shape: Circular
Size: 40.25 inches inside diameter
Orientation: Vertical
Flow straighteners: None
Extension: None
Cyclonic Flow: No Cyclonic flow expected
Meets EPA Method 1 Criteria: Yes

4.2.2 Cyclonic Flow Check: Cyclonic flow checks were done at the exhaust of Furnace 4 during previous testing on September 22, 2005. During the cyclonic flow check, null angles were measured using a digital protractor and it was verified that the average angle of flow was less than twenty degrees from vertical, thus indicating the absence of cyclonic flow.

4.3 Operating Parameters: See Production/Process Data section of Appendix. Confidential batch composition information will not be included in the official report, but will be provided to PSCAA as a supplementary enclosure.

4.4 Process Startups/Shutdowns or Other Operational Changes During Tests: Process was continuous during testing.

5. SAMPLING AND ANALYTICAL PROCEDURES

5.1 Sampling Procedures:

5.1.1 Sampling and Analytical Methods: Testing was in accordance with procedures and methods listed in the Source Test Plan dated June 24, 2009 (see Correspondence Section in the Appendix), including the following: EPA Methods in 40 CFR Part 60, Appendix A, July 1, 2007.

Flow Rate:	EPA Methods 1 and 2 (pitot traverses with EPA Method 29)
CO_2 and O_2:	EPA Method 3/3A (integrated bag samples w/analyzers)
Moisture:	EPA Method 4 (incorporated with EPA Method 29)
Chrome:	EPA Method 29 (isokinetic impinger technique with analysis by ICP-OES/ICP-MS)

5.1.2 Sampling Notes: None

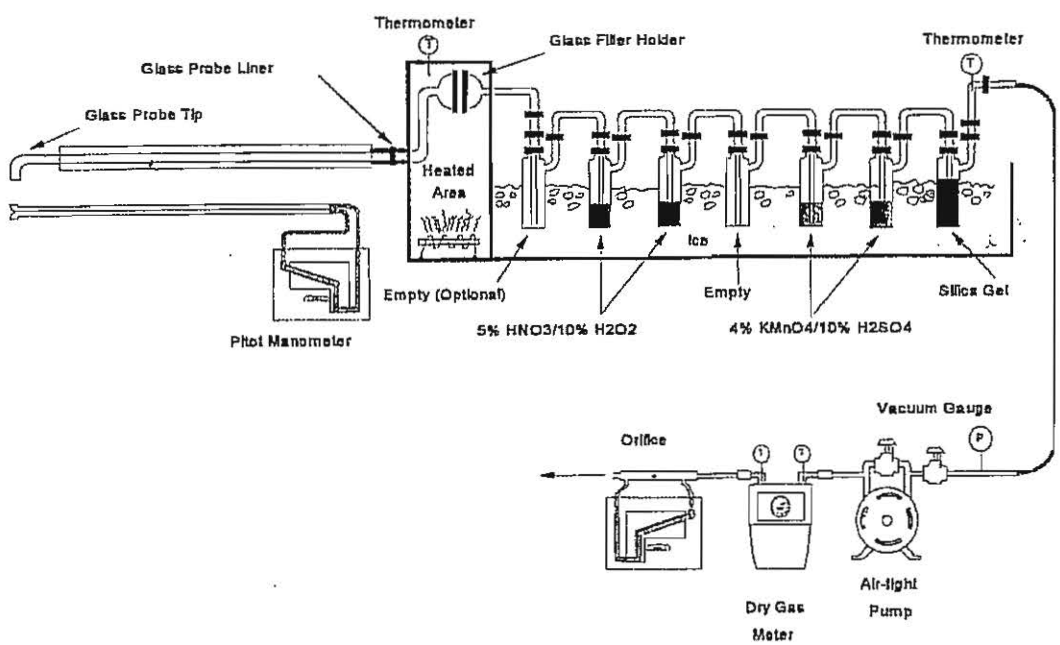
5.1.3 Laboratory Analysis:

Analyte	**Laboratory**
Chrome	Columbia Analytical Services, Kelso, WA

5.2 Sampling Train Diagram:

Figure 1

EPA Method 29 Chrome Sample Train Diagram



5.2.1 Diagram Exceptions: Impingers 4, 5 and 6 were not used (not necessary unless mercury is to be tested)

5.3 Horizon Test Equipment:

5.3.1 Manual Methods:

Equipment Name	**Identification**
Isokinetic Meter Box	CAE Express, Horizon No. 19
Inclined Liquid Manometer	Incorporated with meter box
Probe Liner(s)	Borosilicate Glass
Pitots and Thermocouples	5-16, 5-17
Quartz Nozzles	Q2, Q3
Barometer	Test Van IV

5.3.2 CEM Analyzers and Methods:

Gas	**Brand**	**Model**	**Cal. Span**	**Measurement Method**	**Method**
O_2	Servomex	1400	20.95%	Paramagnetic	3/3A
CO_2	Servomex	1400	21.76%	Chopperless NDIR	3/3A

5.3.3 Bag Sampling Setup:

Integrated Tedlar bag samples were taken from the orifice exhaust of the isokinetic meter boxes used for particulate determinations. The bag contents were then analyzed using the instruments listed above.

6. DISCUSSION

The results of the testing should be valid in all respects. All quality assurance checks including leak checks, instrument checks, and calibrations, were within method-allowable tolerances.

APPENDIX

Abbreviations & Acronyms

Abbreviations and Acronyms Used in the Report

AAC	Atmospheric Analysis & Consulting, Inc.
BAAQMD	Bay Area Air Quality Management District
BACT	Best Achievable Control Technology
BHP	Boiler Horsepower
BIF	Boiler and Industrial Furnace
BLS	Black Liquor Solids
C	Carbon
C_3H_8	Propane
CAS	Columbia Analytical Laboratory
CEM	Continuous Emissions Monitor
CEMS	Continuous Emissions Monitoring System
CERMS	Continuous Emissions Rate Monitoring System
CET	Calibration Error Test
CFR	Code of Federal Regulations
CGA	Cylinder Gas Audit
CH_4	Methane
Cl_2	Chlorine
ClO_2	Chlorine Dioxide
CNCG	Concentrated Non-Condensable Gas
CO	Catalytic Oxidizer
CO_2	Carbon Dioxide
COC	Chain of Custody
CTM	Conditional Test Method
CTO	Catalytic Thermal Oxidizer
DNCG	Dilute Non-Condensable Gas
Dioxins	Polychlorinated Dibenzo-p-dioxins (PCDD's)
dscf	Dry Standard Cubic Feet
EIT	Engineer in Training
EPA	Environmental Protection Agency
ESP	Electrostatic Precipitator
EU	Emission Unit
FID	Flame Ionization Detector
Furans	Polychlorinated Dibenzofurans (PCDF's)
GC	Gas Chromatography
gr/dscf	Grains Per Dry Standard Cubic Feet
H_2S	Hydrogen Sulfide
HAP	Hazardous Air Pollutant
HCl	Hydrogen Chloride
HRSG	Heat Recovery Steam Generator
IDEQ	Idaho Department of Environmental Quality
lb/hr	Pounds Per Hour
LRAPA	Lane Regional Air Protection Agency
MACT	Maximum Achievable Control Technology
MDI	Methylene Diphyenyl Diisocyanate
MDL	Method Detection Limit
MEK	Methyl Ethyl Ketone
MeOH	Methanol
MMBtu	Million British Thermal Units
MRL	Method Reporting Limit
MS	Mass Spectrometry
MSF	Thousand Square Feet
NCASI	National Council for Air and Steam Improvement
NCG	Non-condensable Gases

Abbreviations and Acronyms Used in the Report

NCUAQMD	North Coast Unified Air Quality Management District
NDIR	Non-dispersive Infrared
NESHAP	National Emissions Standards for Hazardous Air Pollutar
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NMVOC	Non-Methane Volatile Organic Compounds
NO_x	Nitrogen Oxides
NPD	Nitrogen Phosphorus Detector
O_2	Oxygen
ODEQ	Oregon Department of Environmental Quality
ORCAA	Olympic Region Clean Air Agency
PAHs	Polycyclic Aromatic Hydrocarbons
PCWP	Plywood and Composite Wood Products
PE	Professional Engineer
PM	Particulate Matter
ppbv	Parts Per Billion by Volume
ppmv	Parts Per Million by Volume
PS	Performance Specification
PSCAA	Puget Sound Clean Air Agency
PSEL	Plant Site Emission Limits
psi	pounds per square inch
PTE	Permanent Total Enclosure
PTM	Performance Test Method
QA/QC	Quality Assurance and Quality Control
QSTI	Qualified Source Testing Individual
RA	Relative Accuracy
RAA	Relative Accuracy Audit
RACT	Reasonably Available Control Technology
RATA	Relative Accuracy Test Audit
RM	Reference Method
RTO	Regenerative Thermal Oxidizer
SCD	Sulfur Chemiluminescent Detector
SCR	Selective Catalytic Reduction System
SO_2	Sulfur Dioxide
SOG	Stripper Off-Gas
SWCAA	Southwest Clean Air Agency
TAP	Toxic Air Pollutant
TCA	Thermal Conductivity Analyzer
TCD	Thermal Conductivity Detector
TGNMOC	Total Gaseous Non-Methane Organic Compounds
TGOC	Total Gaseous Organic Compounds
THC	Total Hydrocarbon
TIC	Tentatively Identified Compound
TO	Thermal Oxidizer
TO	Toxic Organic (as in EPA Method TO-15)
TPH	Tons Per Hour
TRS	Total Reduced Sulfur
TTE	Temporary Total Enclosure
VE	Visible Emissions
VOC	Volatile Organic Compounds
WC	Inches Water Column
WDOE	Washington Department of Ecology
WWTP	Waste Water Treatment Plant

Nomenclature

Nomenclature

Constants	Value	Units	Definition	Ref
Pstd(1)	29.92126	inHg	Standard Pressure	CRC
Pstd(2)	2116.22	lbf / ft^2		CRC
Tstd	527.67	°R	Standard Temperature	CRC
R	1545.33	ft lbf / lbmol °R	Ideal Gas Constant	CRC
MWatm	28.965	lbm / lbmole	Atmospheric (20.946 %O2, 0.033% CO2, Balance N2+Ar)	
MWc	12.011	lbm / lbmole	Carbon	CRC
MWco	28.010	lbm / lbmole	Carbon Monoxide	CRC
MWco2	44.010	lbm / lbmole	Carbon Dioxide	CRC
MWh2o	18.015	lbm / lbmole	Water	CRC
MWno2	46.006	lbm / lbmole	Nitrogen Dioxide	CRC
MWo2	31.999	lbm / lbmole	Oxygen	CRC
MWso2	64.063	lbm / lbmole	Sulfur Dioxide	CRC
MWn2+ar	28.154	lbm / lbmole (Balance with 98.82% N2 & 1.18% Ar)	Emission balance	
C1	385.3211	ft^3 / lbmol	Ideal Gas Constant @ Standard Conditions	
C2	816.5455	inHg in^2/ °R ft^2	Isokentics units correction constant	
Kp	5129.4	ft / min [(inHg lbm/mole) / (°R inH2O)] ^½	Pitot tube constant	Ref 2.5.1

Symbol	Units	Definition	Calculating Equation or Source of Data	EPA
As	in^2	Area, Stack		
An	in^2	Area, Nozzle		
Bws	%	Moisture, % Stack gas	[100 Vw(std) / [Vw(std)+Vm(std)]]	Eq. 5-3
C	ppmv-C	Carbon (General Reporting Basis for Organics)		
C1	ft3/lbmol	Gas Constant @ Standard Conditions	[R Tstd / Pstd(2)]	
C2	inHg in^2/ °R ft^2		[14,400 Pstd / Tstd]	
Cd	lbm-GAS / MMdscf	Mass of gas per unit volume	[Cgas MWgas / C1]	
cg	gr/dscf	Grain Loading, Actual	[15.432 mn / Vm(std) 1,000]	Eq. 5-6
cg @ X%CO2	gr/dscf	Grain Loading Corrected to X% Carbon Dioxide	[X% / CO2%]	
cg @ X%O2	gr/dscf	Grain Loading Corrected to X% Oxygen	[(20.946-X) / (20.946-O2)]	
Cgas	ppmv, %	Gas Concentration, (Corrected)		
Cgas @ X%CO2	ppmv	Gas Concentration Correction to X% Carbon Dioxide	[X% / CO2%]	
Cgas @ X%O2	ppmv	Gas Concentration Correction to X% Oxygen	[(20.946-X%) / (20.946-O2%)]	
Cgas	ppmv		Mgas (lbm/hr) * 1,000,000*385.3211/60*Qsd*mw	
CO	ppmv	Carbon Monoxide		
Co	ft	Outer Circumference of Circular Stack		
Ci	ft	Inner Circumference of Circular Stack		
CO2	%	Carbon Dioxide		
Cp		Pitot tube coefficient		
Ct	lb/hr	Particulate Mass Emissions	[60 cg Qsd/ 7,000]	
dH	in H2O	Pressure differential across orifice		
Dn	in	Diameter, Nozzle		
dp^½		Average square root of velocity pressure		
Ds	in	Diameter, Stack		
E	lb / MMBtu	Pollutant Emission Rate	Cgas Fd MWgas (20.946 / (20.946-O2)) / (1,000,000 C1)	
Fd	dscf / MMBtu	F Factor for Various Fuels		Table 19-1
I	%	Percent Isokinetic	[C2 Ts(abs) Vm(std) / (vs Ps mfg An Ø)]	Eq. 5-8*
Md	lbm / lbmole	Molecular weight, Dry Stack Gas	[(1-%O2-%CO2)(MWn2+ar)+(%O2 MWo2)+(%CO2 MWco2)]	Eq. 3-1*
mfg		Mole fraction of dry stack gas	[1-Bws/100]	
Mgas	lbm/hr	Gaseous Mass Emisisons	[60 Cgas(ppmv) MW Pstd(2) Qsd / 1,000,000 R Tstd]	
mn	mg	Particulate lab sample weight		
Ms	lbm / lbmole	Molecular weight, Wet Stack	[Md mfg +MWh2o (1-mfg)]	Eq. 2-5
MW	lbm / lbmole	Molecular Weight		
NO2	ppmv-NO2	Nitrogen Dioxide (General Reporting Basis for NOx)		
NOx	ppmv-NO2	Nitrogen Oxides (Reported as NO2)		
O2	%	Oxygen		
OPC	%	Opacity		
Pbar	in Hg	Pressure, Barometric		
Pg	in H2O	Pressure, Static Stack		
Po	in Hg	Pressure, Absolute across Orifice	[Pbar + dH / 13.5951]	
Ps	in Hg	Pressure, Absolute Stack	[Pbar + Pg / 13.5951]	Eq. 2-6*
Qa	acf/min	Volumetric Flowrate, Actual	[As vs / 144]	
Qsd	dscf/min	Volumetric Flowrate, Dry Standard	[Qa Tstd mfg Ps] / [Pstd(1) Ts(abs)]	Eq 2-10*
Rf	MMBtu/hr		1,000,000 Mgas (20.946-O2)] / [Cd Fd 20.946]	
SO2	ppmv-SO2	Sulfur Dioxide		
t	in	Wall thickness of a stack or duct		
TGOC	ppmv-C	Total Gaseous Organic Concentration (Reported as C)		
Tm	°F	Temperature, Dry gas meter		
Tm(abs)	°R	Temperature, Absolute Dry Meter	[Tm + 459.67]	
Ts	°F	Temperature, Stack gas		
Ts(abs)	°R	Temperature, Absolute Stack gas	[Ts + 459.67]	
Vlc	ml	Volume of condensed water		
Vm	dcf	Volume, Gas sample		
Vm(std)	dscf	Volume, Dry standard gas sample	[Y Vm Tstd Po] / [Pstd(1) Tm(abs)]	Eq. 5-1
vs	fpm	Velocity, Stack gas	Kp Cp dp^½ [Ts(abs) / (Ps Ms)]^ ½	Eq. 2-9*
Vw(std)	scf	Volume, Water Vapor	0.04707 Vlc	Eq. 5-2
Y		Dry gas meter calibration factor		Fig. 5.6
Ø	min	Time, Total sample		

* Based on equation.

Total Chrome

Total Chrome and Flow Rate Results
Example Calculations
Field Data
Sample Recovery Field Data and Worksheets
Laboratory Results and COC
Traverse Point Locations
Tedlar Bag Field Data and Analyzer Calibration Data

EPA Method 29 Chromium Results

Saint Gobain					Aug 4, 2009	
No.4 Furnace Exhaust					ny,pth	
Seattle, WA					mew	
Vm(std)	dscf	72.88	76.87	71.96		
	dscm	2.06	2.18	2.04		
Q(std)	dscf/min	15,725	16,778	15,847		
Time	min	120.0	120.0	120.0	360.0	
Oxygen	%	16.60	16.60	16.60		
SAMPLE WEIGHTS		Run 1	Run 2	Run 3	Average	
		ug	ug	ug	Upper	Lower
Chromium	ug	771.0	801.0	759.0	777.0	

EPA Method 29 Chromium Results

	Saint Gobain					Aug 4, 2009	
	No.4 Furnace Exhaust					ny,pth	
	Seattle, WA					mew	
	Vm(std)	dscf	72.88	76.87	71.96		
		dscm	2.06	2.18	2.04		
	Q(std)	dscf/min	15,678	16,728	15,825		
	Time	min	120.0	120.0	120.0		
	Oxygen	%	15.42	16.20	16.42		
	CONCENTRATIONS		Run 1	Run 2	Run 3	Average	
			ug/m3	ug/m3	ug/m3	Upper	Lower
***	Chromium	ug/m3	373.61	367.96	372.47	371.35	
	CONCENTRATIONS		Run 1	Run 2	Run 3	Average	
	CORRECTED TO 7%O2		ug/m3	ug/m3	ug/m3	Upper	Lower
***	Chromium	ug/m3	943	1,081	1,148	1,057	

***ITALIC indicates results are at or below detection limit.**

EPA Method 29 Chromium Results

Saint Gobain					Aug 4, 2009	
No.4 Furnace Exhaust					ny,pth	
Seattle, WA					mew	
Vm(std)	dscf	72.88	76.87	71.96		
	dscm	2.06	2.18	2.04		
Q(std)	dscf/min	15,678	16,728	15,825		
Time	min	120.0	120.0	120.0	360.0	
Oxygen	%	15.42	16.20	16.42		
Production rate	ton / hr	5.66	5.66	5.66		
MASS EMISSIONS		Run 1	Run 2	Run 3	Average	
		lbm/hr	lbm/hr	lbm/hr	Upper	Lower
Chromium	lbm/hr	0.0219	0.0231	0.0221	0.0224	
PRODUCTION BASIS		Run 1	Run 2	Run 3	Average	
		lbm / ton	lbm / ton	lbm / ton	Upper	Lower
Chromium	lbm / ton	0.00387	0.00407	0.00390	0.00395	

**ITALIC indicates results are at or below detection limit.*

EPA Method 29 Flow Rate and Moisture Results

Client	Saint Gobain				Aug 4, 2009	Date
Source	No.4 Furnace Exhaust				ny,pth	Operator
Location	Seattle, WA				3302	Job #
Methods	EPA 1-4, EPA 29				mew	Analysist/QA
Definitions	Symbol	Units	Run 1	Run 2	Run 3	Average
Date	3		Aug 4, 2009	Aug 4, 2009	Aug 4, 2009	Time Weighted
Time, Starting			9:16	11:43	14:06	
Time, Ending			11:28	13:49	16:15	
Volume, Gas sample	Vm	dcf	73.155	79.475	75.012	75.9
Temperature, Dry gas meter	Tm	°F	71.3	87.4	91.8	83.5
Temperature, Stack gas	Ts	°F	383.3	395.0	382.9	387.1
Temperature, Stack Dry Bulb	Tdb	°F	na	na	na	
Temperature, Stack Wet Bulb	Twb	°F	na	na	na	
Pressure differential across orifice	dH	in H2O	1.491	1.678	1.568	1.6
Average square root velocity pressure	dp^½	in H2O^½	0.744	0.796	0.749	
Diameter, Nozzle	Dn	in	0.2523	0.2625	0.2523	
Pitot tube coefficient	Cp		0.8124	0.8135	0.8124	
Dry gas meter calibration factor	Y		0.9962	0.9962	0.9962	
Pressure, Barometric	Pbar	in Hg	30.00	30.00	30.00	
Pressure, Static Stack	Pg	in H2O	-0.01	-0.01	-0.01	
Time, Total sample	Ø	min	120.0	120.0	120.0	120.0
Stack Area	As	in²	1,256.6	1,256.6	1,256.6	
Nozzle Area	An	in²	0.0500	0.0541	0.0500	
Oxygen		% O2	15.42	16.20	16.42	16.01
Carbon Dioxide		% CO2	4.27	4.10	3.43	3.93
Molecular weight, Dry Stack	Md	lbm / lbmole	29.42	29.43	29.33	29.39
Pressure, Absolute Stack	Ps	in Hg	30.00	30.00	30.00	30.00
Pressure, avg arcoss orifice	Po	in Hg	30.11	30.12	30.12	30.12
Volume of condensed water	Vlc	ml	113.4	113.4	109.4	
Volume, Dry standard gas sample	Vm(std)	dscf	72.88	76.87	71.96	73.90
Volume, Water Vapor	Vw(std)	scf	5.34	5.34	5.15	
Moisture, % Stack	Bws(1)	%	6.82	6.49	6.68	6.67
Moisture, % Stack (Psychometry-Sat)	Bws(2)	%	na	na	na	
Moisture, % Stack (Theoretical)	Bws(3)	%	na	na	na	
Moisture, % Stack (Psychometry)	Bws(4)	%	na	na	na	
Moisture, % Stack (Predicted)	Bws(5)	%	6.50	6.50	6.50	6.50
Mole Fraction dry Gas	mfg		93.2%	93.5%	93.3%	93.3%
Molecular weight, Wet Stack	Ms	lbm / lbmole	28.65	28.69	28.57	28.64
Velocity, Stack gas	vs	fpm	3,072	3,312	3,095	3,160
Volumetric Flowrate, Actual	Qa	acf/min	26,809	28,901	27,007	27,572
Volumetric Flowrate, Dry Standard	Qsd	dscf/min	15,678	16,728	15,825	16,077
Percent Isokinetic	I	%	97.4	88.9	95.3	93.8

HORIZON ENGINEERING LLC
13585 NE Whitaker Way • Portland, OR 97230
Phone (503) 255-5050 • Fax (503) 255-0505
www.horizonengineering.com

Example Calculations
Metals Emissions

Client: Saint Gobain Source Furnace No. 4

Date 08/04/2009 Project # 3302 Run # 2

Metals Emissions – Mass Rate

Metal Chrome measured 801.0 µg

Sample Volume 76.87 dscf Flow Rate 16,778 dscf/min

Equation:

$$lb-\underline{Cr}/hr = \frac{measured\mu g * mg/1000\mu g}{SampleVolume} * FlowRate * \frac{60\min}{hr} * \frac{lb}{453592.37mg}$$

Calculation:

$$\frac{801.0\ \mu g * mg/1000\mu g}{76.87\ dscf} * \frac{16{,}778\ dscf}{\min} * \frac{60\min}{hr} * \frac{lb}{453592.37mg} = \underline{0.0234}\ \text{lb-}\underline{Cr}\text{/hr}$$

Client: Saint Gobain Source Furnace No. 4
Date 08/04/09 Project # 3302 Run # 2

Chromium Emissions Production Based: lb/ton glass production:

Measured Cr Results, lb/hr 0.0234

Glass Production (Pull Rate), tons/day 135.9

Equation: $$\frac{lbCr}{tonGlass} = \left(\frac{lbCr}{hr}\right) \times \left(\frac{day}{tonsGlass}\right) \times \left(\frac{24hr}{day}\right)$$

Calculation: $$\left(\frac{0.0234\ lbCr}{hr}\right) \times \left(\frac{day}{135.9\ tonsGlass}\right) \times \left(\frac{24hr}{day}\right) = \frac{0.0041\ lbCr}{tonGlass}$$

Client: Saint Gobain Source Furnace No. 4
Date 08/04/09 Project # 3302 Run # 2 Page ____

CHROMIUM CONCENTRATION. mg/dscm

Measured Results, gr/dscf 0.000161

Equation: $CR, mg/dscm = Cr, gr/dscf \times \frac{lb}{7000gr} \times \frac{453{,}592mg}{lb} \times \frac{35.315cubicft}{cubicMeter}$

Calculation: $\underline{0.000161}\ Cr, gr/dscf \times \frac{lb}{7000gr} \times \frac{453{,}592mg}{lb} \times \frac{35.315cubicft}{cubicMeter}$

$= \underline{0.368}\ Cr, mg/dscm = 368\ \mu g/dscm$

$801.0\ \mu g = 0.801\ mg\ Cr$

$\frac{0.801\ mg}{76.87\ dscf} \cdot \frac{15.432\ gr}{g} \cdot \frac{1g}{1000mg} = 0.000161\ gr/dscf$

Client: Saint Gobain Date 08/04/2009

Source Furnace No. 4 Project # 3302 Run # 2

Molecular Weights (lb/lbmol):

CO_2=44.01	O_2=31.999	N_2+Ar=28.154	H_2O=18.015	atm=28.965

Constants:

Pstd(1)=29.92129 in Hg	Tstd=527.67 °R	Kp=5129.4	C2=816.5455inHg in^2/°R ft^2

Pressure, Absolute Stack (Ps):

$$\text{Ps, inHg} = P_{\text{Barometric}} + \frac{P_{\text{static}}}{13.6} = \underline{30.0}\ \text{inHg} + \frac{\underline{-0.01}\ \text{in H2O}}{13.6} = \underline{30.0}\ \text{inHg}$$

Volume, Dry Standard Gas Sample (Vm[std]): $Tm = \underline{87.4}\ \circ F + 459.7 = \underline{547.1} \circ R$

$$Orifice\ Press = Pb\ \underline{30.0}\ inHg + \frac{\underline{1.678}\,\Delta H}{13.6} = \underline{30.12}\ inHg$$

$$Vm(std)\,ft^3 = \frac{Y \times MeterVol \times Tstd \times Orifice\ Pres(Po)}{Pstd(1) \times Tm \circ R}$$

$$= \frac{\underline{0.99618} \times \underline{79.475}\ ft^3 \times 527.67 \circ R \times (Po\ \underline{30.12}\ inHg)}{29.9213 inHg \times \underline{547.1} \circ R} = \underline{76.875}\ dscf$$

Moisture, % Stack Gas (bws): $V_{wstd} = 0.04707 \times Cond.H2O, ml = 0.04707 \times \underline{113.4}\ ml = \underline{5.338} scf$

$$\text{bws} = 100 \times \frac{V_{wstd}}{V_{wstd} + V_{mstd}} = \frac{\underline{5.338}\ scf}{\underline{5.338}\ scf + \underline{76.875}\ dscf} = \underline{6.49}\ \%$$

Mole Fraction Gas (mfg): $1 - \frac{\text{bws}}{100} = 1 - \frac{\underline{6.49}\ \%}{100} = \underline{0.9351}$

Molecular Weight, Dry, Stack (Md):

$$Md \frac{lb}{lbmol} = \left[(1 - \frac{O_2}{100} - \frac{CO_2}{100}) \times MolWtN2Ar\right] + \left[\frac{O_2}{100} \times MolWtO2\right] + \left[\frac{CO_2}{100} \times MolWtCO2\right]$$

$$= \left[(1 - \frac{\underline{16.2}\,\%O_2}{100} - \frac{\underline{4.1}\,\%CO_2}{100}) \times 28.154 \frac{lb}{lbmol}\right] + \left[\frac{\underline{16.2}\,\%O_2}{100} \times 31.999 \frac{lb}{lbmol}\right] + \left[\frac{\underline{4.1}\,\%CO_2}{100} \times 44.010 \frac{lb}{lbmol}\right]$$

$$= \underline{29.43}\ \frac{lb}{lbmol}$$

Client: Saint Gobain Date 08/04/2009

Molecular Weight, Wet, Stack (Ms):

$$Ms\frac{lb}{lbmol} = (Md \times mfg) + (MolWtH_2O \times (1 - mfg)) = \left(\frac{29.43\ lb}{lbmol} \times \underline{0.9351}\right) + (18.015 \times (1 - .9351))$$

$$= \underline{28.69}\ \frac{lb}{lbmol}$$

Stack gas (vs): $Ts = \underline{395} \circ F + 459.7 = \underline{854.7} \circ R$

$$= vs\frac{feet}{\min} = Kp \times Cp \times dp\sqrt{inH_2O} \times \sqrt{\frac{Ts \circ R}{Ps \times Ms}}$$

$$= 5129.4\,ft/\min \ldots \times \underline{0.8135} \times \underline{0.796}\ dp\sqrt{inH_2O} \times \sqrt{\frac{\underline{854.7} \circ R}{\underline{30.0}\ inHg \times \underline{28.69}\ \frac{lb}{lbmol}}} = \underline{3309.9}\ \frac{ft}{\min}$$

Flow Rate, Actual (Qa):

$$Qa\frac{actualCubicFeet}{\min} = \frac{AreaStack \times vs}{144} = \frac{\underline{1256.6}\ in^2 \times \underline{3309.9}\ \frac{ft}{\min}}{144} = \underline{28,884}\ acfm$$

Flow Rate, Dry Standard (Qsd):

$$Qsd\frac{dryStdFt^3}{\min} = \frac{Qa \times Tstd \times mfg \times Ps}{Pstd(1) \times Ts \circ R} = \frac{\underline{28,884}\ acfm \times 527.67 \circ R \times \underline{0.9351} \times \underline{30.0}\ inHg}{29.9213 inHg \times \underline{854.7} \circ R}$$

$$= \underline{16,719}\ \frac{dscf}{\min}$$

Field Data Sheet

HORIZON ENGINEERING LLC
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: Saint Gobain
Plant: Seattle, WA
Location: #4 Furnace
Sample Location: Exit

Date 8/4/09
Test Method 29
Concurrent Testing —
Run # 1
Operator NY Support PTH
Temperature, Ambient (Ta) 69
Moisture 6.5% Tdb — Twb —
Press., Static (Pstat) 0.01 Press., Bar (Pb) 30.0
Cyclonic Flow Expected ? NO If yes, avg. null angle — degrees

Probe 5-17 (g / s) Cp .8124 Heat Set 250 °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0@3 Post @ Lo 0@3 @
Nozzle .2523 Q3 Sample Box 188
Filter — Heat Set 250 °F
Meter Box 19 dH@ 1.85111 Y .99618
Meter Leak Check Pretest: 0.003 cfm 15 inHg Post: 0.002 cfm 12 inHg

Stack Diagram

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2) (dP's)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts) Amb:	PROBE °F (Tp) Amb:	OVEN Filter °F (To) Amb:	IMPINGER Outlet °F (Ti) Amb:	METER Inlet/Avg. °F (Tm-in) Amb:	METER Outlet °F (Tm-out) Amb:	Pump Vacuum inHg (Pv)
		9:16	251.500										
1	5		254.73	.65	1.51	1.5	370	247	259	53	67	68	2
2	10		257.96	.65	1.51	1.5	371	249	253	52	67	67	2
3	15		261.84	.96	2.24	2.2	377	252	257	53	67	69	2
4	20		265.53	.86	1.92	1.9	407	245	255	54	68	73	2
5	25		268.97	.70	1.57	1.6	414	250	251	55	68	76	2
6	30		272.14	.62	1.39	1.4	417	246	247	55	68	78	2
7	35		275.08	.55	1.23	1.2	415	251	253	55	70	81	2
8	40		277.90	.47	1.13	1.1	361	246	250	55	70	82	2
9	45		281.14	.58	1.36	1.4	379	244	259	55	72	83	2
10	50		284.37	.58	1.35	1.4	387	248	252	54	72	83	2
11	55		287.46	.55	1.27	1.3	397	250	252	55	73	85	2
12	60	1016 / 1028	290.555	.55	1.25	1.3	414	252	250	56	74	86	2
1	65		295.79	1.8	3.91	3.9	444	251	250	57	75	77	5
2	70		300.46	1.3	3.00	3.0	400	249	257	55	76	87	5
3	75		305.43	1.5	3.43	3.4	413	257	258	57	77	91	5
4	80		309.93	1.2	2.75	2.8	414	251	257	58	78	93	5
5	85		313.28	.65	1.51	1.5	401	247	256	58	79	93	5
6	90		317.20	.94	2.13	2.1	425	247	255	60	80	92	4
7	95		318.93	.15	.355	.36	387	249	252	60	80	93	5
8	100		320.59	.15	.355	.36	388	248	255	63	81	90	2
9	105		321.73	.07	.169	.17	372	249	254	61	82	89	2
10	110		322.72	.05	.135	.14	279	251	255	62	82	88	2
11	115		323.69	.05	.134	.13	284	245	254	62	83	86	2
12	120	1128	324.655	.05	.134	.13	282	257	257	62	82	87	2

Notes:

Field Data Sheet

HORIZON ENGINEERING
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: Saint Gobain
Plant: Seattle, WA
Location: F4
Sample Location: Exit

Date 8/4/09
Test Method 29
Concurrent Testing –
Run # 2
Operator NY Support PTH
Temperature, Ambient (Ta) 80
Moisture 6.5% Tdb – Twb –
Press., Static (Pstat) -.01 Press., Bar (Pb) 30.0
Cyclonic Flow Expected ? NO If yes, avg. null angle – degrees

Stack Diagram

Probe 5-16 (g / s) Cp .8135 Heat Set 250 °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi 0@3 Post 0@3
Lo 0@3 0@3
Nozzle .2625 QZ Sample Box
Filter – Heat Set 250 °F
Meter Box 19 dH@ 1.85111 Y .99618
Meter Leak Check Pretest: 0.006 cfm 15 inHg
Post: 0.003 cfm 15 inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2) (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
		1143	324.833				Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
1	5		330 –	1.8	4.02	4.0	429	240	250	63	83	81	9
2	10		335.60	1.8	4.01	4.0	438	248	252	62	83	88	9
3	15		340 –	1.5	3.48	3.5	407	249	254	62	84	93	8
4	20		345.72	1.5	3.48	3.5	416	248	255	61	85	94	8
5	25		350.25	1.2	2.79	2.8	415	249	255	63	86	96	7
6	30		353.93	.72	1.69	1.7	401	246	252	63	84	94	7
7	35		356.08	.25	.582	.58	396	247	257	64	82	89	2
8	40		358.17	.28	.652	.65	403	248	255	62	82	87	2
9	45		359.97	.19	.442	.44	398	249	254	62	81	86	2
10	50		361.43	.12	.287	.29	373	247	254	63	81	86	2
11	55		362.74	.10	.246	.25	349	247	254	64	82	86	2
12	60	1243 / 1249	363.969 / 364.031	.08	.214	.21	284	248	255	61	81	85	2
1	65		367.45	.64	1.56	1.6	360	247	252	62	81	85	5
2	70		371.18	.79	1.87	1.9	385	249	257	59	81	90	5
3	75		374.95	.85	1.94	1.9	421	249	254	59	82	93	5
4	80		378.60	.78	1.77	1.8	426	248	255	58	83	95	6
5	85		381.99	.65	1.46	1.5	433	246	253	58	83	96	6
6	90		384.85	.45	1.14	1.1	332	246	253	58	84	96	5
7	95		387.42	.35	.855	.86	365	246	259	61	84	96	4
8	100		390.50	.54	1.30	1.3	377	248	256	63	85	95	3
9	105		393 –	.67	1.58	1.6	393	248	255	64	85	95	4
10	110		397.34	.70	1.61	1.66	412	247	254	65	85	97	5
11	115		400.80	.70	1.59	1.6	430	248	254	64	86	98	5
12	120	13:49	404.370	.70	1.59	1.6	438	246	255	66	86	97	5

Notes:
Leak check at port change 0.004@15

Field Data Sheet

HORIZON ENGINEERING LLC
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: Saint Gobain
Plant: Seattle, WA
Location: #4 Furnace
Sample Location: Exit

Date 8/4/09
Test Method 29
Concurrent Testing -
Run # 3
Operator NY Support PTH
Temperature, Ambient (Ta) 80
Moisture 6.5% Tdb - Twb -
Press., Static (Pstat) -.01 Press., Bar (Pb) 30.0
Cyclonic Flow Expected ? NO If yes, avg. null angle ___ degrees

Stack Diagram

Probe 5+17 (g / s) Cp .8124 Heat Set 250 °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O — Pre: Hi 0@3 Post 0@3; Lo 0@3 0@3
Nozzle .2523 Q3 Sample Box 188
Filter — Heat Set 250 °F
Meter Box 19 dH@ 1.85111 Y .99618
Meter Leak Check — Pretest: 0.003 cfm 15 inHg; Post: 0.002 cfm 15 inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading cuft (Vm)	Velocity Head in H2) (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
		14:06	404.575				Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
1	5		408.08	.64	1.52	1.5	380	249	246	60	84	85	2
2	10		411.35	.64	1.51	1.5	392	249	246	57	86	91	2
3	15		415.10	.85	1.95	2.0	415	247	254	60	86	92	2
4	20		418.63	.79	1.79	1.8	431	246	255	61	86	96	2
5	25		422.18	.76	1.71	1.7	436	254	254	62	86	97	2
6	30		425.60	.71	1.61	1.6	434	253	255	63	88	99	2
7	35		428.71	.52	1.27	1.3	372	252	259	64	88	99	2
8	40		431.68	.49	1.17	1.2	386	262	253	65	88	99	2
9	45		434.95	.60	1.42	1.4	395	248	252	63	88	98	2
10	50		438.20	.58	1.36	1.4	403	244	252	61	88	99	2
11	55		441.44	.58	1.36	1.4	409	238	263	60	88	99	2
12	60	1508 / 1515	444.670	.60	1.36	1.4	432	250	256	60	89	99	2
1	65		450.00	1.8	4.00	4.0	447	236	259	60	87	90	3
2	70		454.72	1.3	3.04	3.0	403	249	252	55	88	95	3
3	75		459.95	1.6	3.71	3.7	413	250	254	57	88	98	3
4	80		464.98	1.5	3.42	3.4	431	244	256	58	88	101	4
5	85		469.18	1.0	2.31	2.3	419	255	259	58	88	102	4
6	90		473.09	.85	2.00	2.0	405	244	250	58	89	101	4
7	95		474.77	.14	.345	.35	362	247	251	59	89	100	4
8	100		476.10	.09	.232	.23	328	251	254	62	89	98	2
9	105		477.56	.06	.161	.16	295	248	252	63	89	96	2
10	110		478.24	.04	.115	.12	240	250	258	67	89	93	2
11	115		478.98	.03	0.09	.09	274	252	252	67	88	87	2
12	120	1615	479.703	.03	0.08	.08	288	257	262	67	87	89	2

Notes:
405.978 @ 2 min pre leak check
406.094 post Leak check
Paused @ 14:08 for Leak check
Restarted @ 14:10

Sample Recovery

Saint Gobain
No.4 Furnace Exhaust
Seattle, WA
EPA 4/29

Aug 4, 2009
ny,pth
mew

			Run 1		Run 2		Run 3	
Impinger Contents			3	4	3	4	3	4
	Rinse #2							
	Impinger, Contents,Condensate & Rinse	g	124.0	468.0	117.0	456.0	116.0	454.0
spg	Impinger, Contents & Condensate	g	20.0	372.0	20.0	364.0	20.0	360.0
g/ml	Impinger	g	20.0	59.0	20.0	50.0	20.0	51.0
1.05900	10% H2O2 / 5% HNO3	ml		200.0		200.0		200.0
1.15155	4% KMnO4 / 10% H2SO4	ml		0.0		0.0		0.0
1.00163	0.1 N HNO3	ml		0.0		0.0		0.0
0.99823	H2O	ml		0.0		0.0		0.0
1.08784	8N HCL / H2O	ml		0.0		0.0		0.0
	Condensate	g		101.2		102.2		97.2
	Rinse	g	104.0	96.0	97.0	92.0	96.0	94.0
	0.1 N HNO3	gm	104.0	96.0	97.0	92.0	96.0	94.0
		ml	103.8	95.8	96.8	91.9	95.8	93.8
Rinse + Initial	10% KMnO4	gm						
		ml						
	10% H2O2 / 5% HNO3	gm						
		ml		200.0		200.0		200.0
	8N HCL / H2O	gm						
		ml						
Silica Gel Impinger	Final weight	g		532.0		531.0		532.0
	Initial weight	g		520.0		520.0		520.0
	Gain	g		12.0		11.0		12.0
Total Moisture Gain	Condensate + Silica Gel gain	g		113.2		113.2		109.2
Vlc	Net Moisture Gain	ml		113.4		113.4		109.4

HORIZON ENGINEERING LLC
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Phone (503) 255-5050 • Fax (503) 255-0505
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Sample Recovery Worksheet – EPA Method 29 Multi-Metals

Client: St. Gobain Source: Furnace # 4

Run No.: 1 Test Date: 08/04/09

Container No.	Empty Container (grams)	Impinger Contents (grams)	Impinger Contents w/ Rinse (grams)	Additional Impinger Contents with Rinse (grams)
#1 Filter ______				
#3 Probe Rinse, HNO_3	20		124	
#4 HNO_3 or HNO_3/H_2O_2	59	372	468	
#5A, 0.1 N HNO_3				
# 5B $KMNO_4/H_2SO_4/H_2O$				
#5C 8N HCl / H_2O				
#6 Silica Gel	520	532		

Run No.: Test Date:

Container No.	Empty Container (grams)	Impinger Contents (grams)	Impinger Contents w/ Rinse (grams)	Additional Impinger Contents with Rinse (grams)
#1 Filter ______				
#3 Probe Rinse, HNO_3	20		117	
#4 HNO_3 or HNO_3/H_2O_2	50	364	456	
#5A, 0.1 N HNO_3				
# 5B $KMNO_4/H_2SO_4/H_2O$				
#5C 8N HCl / H_2O				
#6 Silica Gel	520	531		

Run No.: 3 Test Date:

Container No.	Empty Container (grams)	Impinger Contents (grams)	Impinger Contents w/ Rinse (grams)	Additional Impinger Contents with Rinse (grams)
#1 Filter ______				
#3 Probe Rinse, HNO_3	20		116	
#4 HNO_3 or HNO_3/H_2O_2	51	360	454	
#5A, 0.1 N HNO_3				
# 5B $KMNO_4/H_2SO_4/H_2O$				
#5C 8N HCl / H_2O				
#6 Silica Gel	520	532		

1317 South 13th Avenue Kelso, Washington 98626 (360) 577-7222 (360) 636-1068 fax

Columbia Analytical Services INC
An Employee - Owned Company

September 1, 2009 Analytical Report for Service Request No: K0907199

Margery Heffernan
Horizon Engineering, LLC
13585 NE Whitaker Way
Portland, OR 97230

RE: Saint Gobain/3302

Dear Margery:

Enclosed are the results of the samples submitted to our laboratory on August 07, 2009. For your reference, these analyses have been assigned our service request number K0907199.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.caslab.com. All results are intended to be considered in their entirety, and Columbia Analytical Services, Inc. (CAS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please call if you have any questions. My extension is 3316. You may also contact me via Email at JChristian@caslab.com.

Respectfully submitted,

Columbia Analytical Services, Inc.

Jeff Christian
Laboratory Director

JC/RH

Chain of Custody Documentation

Columbia Analytical Services
An Employee-Owned Company

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222 • FAX (360) 636-1068

DATE ______ PAGE 1 OF 2 31

PROJECT NAME Saint Gobain # 3302
PROJECT MANAGER Paul Heffernan
COMPANY/ADDRESS Horizon Engineering
13585 NE Whitaker Way
Portland OR 97230 PHONE 503 255 5050
SAMPLERS SIGNATURE [signature]

ANALYSIS REQUESTED: EPA M-29: Cr

SAMPLE I.D.	DATE	TIME	LAB I.D.	SAMPLE MATRIX	NUMBER OF CONTAINERS	EPA M-29: Cr	REMARKS
Source: Furnace No. 4							
Cont. 3 Run 1	8/4/09	–		Aqu	1	✓	
Cont. 3 Run 2	"	–		"	1	✓	
Cont. 3 Run 3	"	–		"	1	✓	
Cont. 4 Run 1	"	–		"	1	✓	
Cont. 4 Run 2	"	–		"	1	✓	
Cont. 4 Run 3	"	–		"	1	✓	
Cont. 1 Run 1	"	–		Filter	1	✓	
Cont. 1 Run 2	"	–		"	1	✓	
Cont. 1 Run 3	"	–		"	1	✓	

RELINQUISHED BY:
Signature [signature]
Printed Name [signature]
Firm Horizon Eng
Date/Time 8/7/09 900

RECEIVED BY:
Signature [signature]
Printed Name [signature]
Firm MS
Date/Time 8/7/09 9:00

TURNAROUND REQUIREMENTS
___ 24 hr ___ 48 hr. ___ 5 day
X Standard (10-15 working days)
___ Provide Verbal Preliminary Results
___ Provide FAX preliminary Results
Requested Report Date ______

REPORT REQUIREMENTS
___ I. Routine Report
X II. Report (includes DUP.MS. MSD, as required, may be charged as samples)
___ III. Data Validation Report (includes All Raw Data)
___ IV. CLP Deliverable Report

INVOICE INFORMATION:
P.O.# ~~3313~~ 3302
Bill To Emily Bagwell

SAMPLE RECEIPT:
Shipping VIA: ______
Shipping #: ______
Condition: ______
Lab No: K0907195

RELINQUISHED BY:
Signature [signature]
Printed Name [signature]
Firm CAS
Date/Time 8/7/09 1:30

RECEIVED BY:
Signature [signature]
Printed Name [signature]
Firm CAS
Date/Time 8/7/09 1330

SPECIAL INSTRUCTIONS/COMMENTS:

please send report to: mheffernan@horizonengineering.com

DISTRIBUTION: WHITE - return to originator; YELLOW - lab; PINK - retained by originator

COC blank 2-2007

Columbia Analytical Services
An Employee - Owned Company

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

1317 South 13th Ave. • Kelso, WA 98626 • (360) 577-7222 • (800) 695-7222 • FAX (360) 636-1068

DATE ______ PAGE 2 OF 2

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PROJECT NAME Saint Gobain # 3302

PROJECT MANAGER

COMPANY/ADDRESS See Page 1 of 2

PHONE

SAMPLERS SIGNATURE

ANALYSIS REQUESTED

SAMPLE I.D.	DATE	TIME	LAB I.D.	SAMPLE MATRIX	NUMBER OF CONTAINERS	EPA M-29: Cr	REMARKS
Cont. 8A	8/4/09	–		Aqu	1	✓	
Cont. 9	"	–		"	1	✓	
Cont. 12	"	–		Filter	1	✓	3 blanks

RELINQUISHED BY:
Signature
Printed Name
Firm
Date/Time 8/7/09 900

RECEIVED BY:
Signature
Printed Name
Firm CAS
Date/Time 8-7-09 9:00

TURNAROUND REQUIREMENTS
___ 24 hr ___ 48 hr. ___ 5 day
Y Standard (10-15 working days)
___ Provide Verbal Preliminary Results
___ Provide FAX preliminary Results
Requested Report Date ______

REPORT REQUIREMENTS
___ I. Routine Report
X II. Report (includes DUP.MS. MSD, as required, may be charged as samples)
___ III. Data Validation Report (includes All Raw Data)
___ IV. CLP Deliverable Report

INVOICE INFORMATION:
P.O.# 3302
Bill To Emily Bagnell

SAMPLE RECEIPT:
Shipping VIA:
Shipping #:
Condition:
Lab No: K0907197

RELINQUISHED BY:
Signature
Printed Name
Firm CAS
Date/Time 8-7-09 1:30

RECEIVED BY:
Signature
Printed Name
Firm
Date/Time 8/7/09 1330

SPECIAL INSTRUCTIONS/COMMENTS:

DISTRIBUTION: WHITE - return to originator; YELLOW - lab; PINK - retained by originator

COC blank 2-2007

Columbia Analytical Services, Inc.
Cooler Receipt and Preservation Form

PC [illegible]

Client / Project: Horizon Service Request K09 07199

Received: 8/7/09 Opened: 8/7/09 By: Brad

1. Samples were received via? US Mail Fed Ex UPS DHL GH GS PDX Courier Hand Delivered
2. Samples were received in: (circle) Cooler Box Envelope Other ______ NA
3. Were custody seals on coolers? NA Y N If yes, how many and where? ______
   If present, were custody seals intact? Y N If present, were they signed and dated? Y N
4. Is shipper's air-bill filed? If not, record air-bill number: ______ NA Y N
5. **Temperature of cooler(s) upon receipt (°C):** ______
   Temperature Blank (°C): ______
   Thermometer ID: ______
6. If applicable, list Chain of Custody Numbers: ______
7. Packing material used. *Inserts Baggies Bubble Wrap Gel Packs Wet Ice Sleeves Other* N/A
8. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
9. **Did all bottles arrive in good condition (unbroken)?** *Indicate in the table below.* NA Y N
10. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
11. Did all sample labels and tags agree with custody papers? *Indicate in the table below* NA Y N
12. **Were appropriate bottles/containers and volumes received for the tests indicated?** NA Y N
13. Were the pH-preserved bottles tested* received at the appropriate pH? *Indicate in the table below* NA Y N
14. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
15. **Are CWA Microbiology samples received with >1/2 the 24hr. hold time remaining from collection?** NA Y N
16. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Sample ID on Bottle	Sample ID on COC

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

**Does not include all pH preserved sample aliquots received. See sample receiving SOP (SMO-GEN).*

Additional Notes, Discrepancies, & Resolutions: ______

Metals

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Horizon Engineering, LLC		**Service Request:**	K0907199
Project:	Saint Gobain/3302		**Date Collected:**	08/04/09
Sample Matrix:	Misc.		**Date Received:**	08/07/09
			Date Extracted:	08/17,18/09

Total Metals
Units: Micrograms (µg)
(Field Blank Corrected)

			Front Half Run - 1 (Analytical Fraction 1A)		**Back Half Run - 1** (Analytical Fraction 2A)		**Total Front Half + Back Half**
	Sample Name:		**Furnace No. 4**		**Furnace No. 4**		-
	Lab Code:		K0907199-001,-007		K0907199-004		-
	Date Analyzed:		08/19/09		08/18,19/09		-
Analyte	**EPA Method**	**Front Half MRL**		**Back Half MRL**		**Total MRL**	
Chromium	29/200.8	1.0	770	0.1	0.6	1.1	771

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Horizon Engineering, LLC
Project: Saint Gobain/3302
Sample Matrix: Misc.

Service Request: K0907199
Date Collected: 08/04/09
Date Received: 08/07/09
Date Extracted: 08/17,18/09

Total Metals
Units: Micrograms (µg)
(Field Blank Corrected)

			Front Half Run - 2 (Analytical Fraction 1A)		**Back Half Run - 2** (Analytical Fraction 2A)		**Total Front Half + Back Half**
	Sample Name:		**Furnace No. 4**		**Furnace No. 4**		-
	Lab Code:		K0907199-002,-008		K0907199-005		-
	Date Analyzed:		08/19/09		08/18,19/09		-
Analyte	**EPA Method**	**Front Half MRL**		**Back Half MRL**		**Total MRL**	
Chromium	29/200.8	1.0	801	0.1	0.2	1.1	801

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Horizon Engineering, LLC	**Service Request:**	K0907199
Project:	Saint Gobain/3302	**Date Collected:**	08/04/09
Sample Matrix:	Misc.	**Date Received:**	08/07/09
		Date Extracted:	08/17,18/09

Total Metals
Units: Micrograms (µg)
(Field Blank Corrected)

			Front Half Run - 3 (Analytical Fraction 1A)		**Back Half Run - 3** (Analytical Fraction 2A)		**Total Front Half + Back Half**
	Sample Name:		**Furnace No. 4**		**Furnace No. 4**		-
	Lab Code:		K0907199-003,-009		K0907199-006		-
	Date Analyzed:		08/19/09		08/18,19/09		-
Analyte	**EPA Method**	**Front Half MRL**		**Back Half MRL**		**Total MRL**	
Chromium	29/200.8	1.0	757	0.1	2.0	1.1	759

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Horizon Engineering, LLC	**Service Request:**	K0907199
Project:	Saint Gobain/3302	**Date Collected:**	08/04/09
Sample Matrix:	Misc.	**Date Received:**	08/07/09
		Date Extracted:	08/17,18/09

Total Metals
Units: Micrograms (μg)

	Sample Name:		**Front Half Blank** (Analytical Fraction 1A)		**Back Half Blank** (Analytical Fraction 2A)
	Lab Code:		K0907199-010,-012		K0907199-010,-011
	Date Analyzed:		08/19/09		08/18,19/09
Analyte	**EPA Method**	**Front Half MRL**		**Back Half MRL**	
Chromium	29/200.8	1.0	1.6	0.1	0.57

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Horizon Engineering, LLC		**Service Request:**	K0907199
Project:	Saint Gobain/3302		**Date Collected:**	NA
Sample Matrix:	Misc.		**Date Received:**	NA
			Date Extracted:	08/17,18/09

Total Metals
Units: Micrograms (μg)

	Sample Name:		**Method Blank - Front Half**		**Method Blank - Back Half**
	Lab Code:		K0907199-MBF		K0907199-MBB
	Date Analyzed:		08/19/09		08/18,19/09
Analyte	**EPA Method**	**Front Half MRL**		**Back Half MRL**	
Chromium	29/200.8	1.0	ND	0.1	ND

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Horizon Engineering, LLC	**Service Request:**	K0907199
Project:	Saint Gobain/3302	**Date Collected:**	08/04/09
Sample Matrix:	Misc.	**Date Received:**	08/07/09
		Date Extracted:	08/17,18/09
		Date Analyzed:	08/18,19/09

Duplicate Summary
Total Metals
Units: Micrograms (µg)
(Field Blank Corrected)

Sample Name: Furnace No. 4: Back Half Run - 1 (Analytical Fraction 2A)
Lab Code: K0907199-004D

Analyte	**EPA Method**	**MRL**	**Sample Result**	**Duplicate Sample Result**	**Average**	**Relative Percent Difference**
Chromium	29/200.8	0.1	0.6	0.6	0.6	<1

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Horizon Engineering, LLC	**Service Request:**	K0907199
Project:	Saint Gobain/3302	**Date Collected:**	08/04/09
Sample Matrix:	Misc.	**Date Received:**	08/07/09
		Date Extracted:	08/17,18/09
		Date Analyzed:	08/18,19/09

Matrix Spike Summary
Total Metals
Units: Micrograms (µg)
(Field Blank Corrected)

Sample Name: Furnace No. 4: Back Half Run - 1 (Analytical Fraction 2A)
Lab Code: K0907199-004S

Analyte	**MRL**	**Spike Level**	**Sample Result**	**Spiked Sample Result**	**Percent Recovery**	**CAS Percent Recovery Acceptance Limits**
Chromium	0.1	7.8	0.6	8.7	104	70-130

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Horizon Engineering, LLC	**Service Request:**	K0907199
Project:	Saint Gobain/3302	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Analyzed:	08/19/09

Laboratory Control Sample Summary (Front Half)
Total Metals
Units: µg/L (ppb)

Source: CAS Spike Solution

Analyte	**EPA Method**	**True Value**	**Result**	**Percent Recovery**	**CAS Percent Recovery Acceptance Limits**
Chromium	29/200.8	100	104	104	85-115

COLUMBIA ANALYTICAL SERVICES, INC.

QA/QC Report

Client:	Horizon Engineering, LLC	**Service Request:**	K0907199
Project:	Saint Gobain/3302	**Date Collected:**	NA
LCS Matrix:	Water	**Date Received:**	NA
		Date Analyzed:	08/18,19/09

Laboratory Control Sample Summary (Back Half)
Total Metals
Units: µg/L (ppb)

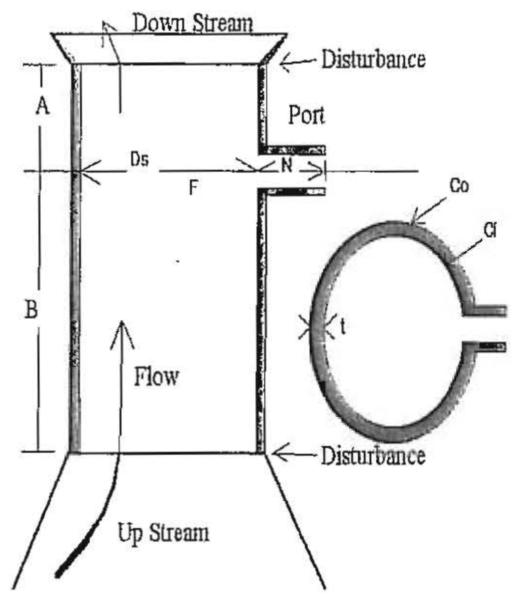
Source: CAS Spike Solution

Analyte	**EPA Method**	**True Value**	**Result**	**Percent Recovery**	**CAS Percent Recovery Acceptance Limits**
Chromium	29/200.8	20	20.4	102	85-115

Traverse Point Locations

Saint Gobain	4-Aug-09
Furnace 4	NY
Seattle, WA	3302
EPA 1	MEW

Outer Circumference	Co	in	
Wall thickness	t	in	
INSIDE of FAR WALL to OUTSIDE of Nipple	F	in	43.25
INSIDE of NEAR WALL to OUTSIDE of Nipple	N	in	3
STACK WALL to to OUTSIDE of Nipple	N-t	in	
DOWNstream Disturb	A	in	144.0
UPstream Disturb	B	in	204.0
Inner Diameter	Ds	in	40.25
Area	As	sqin	1272.4
DOWNstream Ratio	A/Ds		3.58
UPstream Ratio	B/Ds		5.07
Minimum #Pts (Particulate)			20
Minimum #Pts/Diameter			10
Minimum #Pts (NON-Particulate)			16
Minimum #Pts/Diameter			8
Actual Points per Diameter			12
Actual Points Used			24



Trav Pt #No	Fract Stk ID (f)	Stack ID (Ds)	Actual Points (Dsxf)	Nearest 8ths (TP)	Adjusted Points (TP)	Traverse Points (TP + N)	Traverse Points (TP + N)
1	2.13%	40.3	0.9	0.875	1	4	4
2	6.70%	40.3	2.7	2.75	2.75	5.75	5 3 / 4
3	11.81%	40.3	4.8	4.75	4.75	7.75	7 3 / 4
4	17.73%	40.3	7.1	7.125	7.125	10.125	10 1 / 8
5	25.00%	40.3	10.1	10.125	10.125	13.125	13 1 / 8
6	35.57%	40.3	14.3	14.375	14.375	17.375	17 3 / 8
7	64.43%	40.3	25.9	25.875	25.875	28.875	28 7 / 8
8	75.00%	40.3	30.2	30.25	30.25	33.25	33 1 / 4
9	82.27%	40.3	33.1	33.125	33.125	36.125	36 1 / 8
10	88.19%	40.3	35.5	35.5	35.5	38.5	38 1 / 2
11	93.30%	40.3	37.6	37.5	37.5	40.5	40 1 / 2
12	97.87%	40.3	39.4	39.375	39.25	42.25	42 1 / 4

HORIZON ENGINEERING LLC
13585 NE Whitaker Way • Portland, OR 97230
Phone (503) 255-5050 • Fax (503) 255-0505
www.horizonengineering.com

Calibration Field Record

Client: St Gobain
Test Date: 9/5/09
Source: 2N + 25

Tester(s): JH, KR/T PH
Observer: —
Datalogger: Testpoint
Conditioner: M+C 11 Universal 5

Leak Checks: Pre-OK Post-OK Probe placement Centroid	Cylinder #	Gas	Cylinder Value (Cv)	Analyzer Calibration Response (Cdir)	Resp. Time (secs)	Start Run 1 System Calibration Response (Cs)	End Run 1 Start Run 2 System Calibration Response (Cs)	End Run 2 Start Run 3 System Calibration Response (Cs)	End Run 3 System Calibration Response (Cs)	
Times				0736		0751	1347	1629	1812	
O2% ch 1	Air	O2	20.9	20.9	90				20.9	
Range/CS 25 20.9	05	O2	11.61	11.8		11.62	11.63	11.05	11.59	
Analyzer Model Servo	22	N2	0.0	-.00		.03	.04	0.02	0.02	
Analyzer SN: 33										
CO2 % ch 2	35	CO2	21.76	21.76	90					
Range/CS 25 21.76	22	CO2	12.52	12.25		12.20	11.75	12.02	11.99	
Analyzer Model Servo	05	N2	0.0	-0.01		.01	.06	.10	0.08	
Analyzer SN: 166	12	CO_2	5.97	5.96						
~~CO~~ SO2 ppm ch 7	55	~~CO~~ SO2	220.7	220.7	120					
Range/CS 250 220.7	56	~~CO~~ SO2	93.1	93.4		91.0	91	92.3	93.3	
Analyzer Model Ametek	05	N2	0.0	.01		2.5	2.5	2.8	4.1	
Analyzer SN: 03	51	SO2	51.7	50.1						
~~NOx~~ SO2 ppm ch 8	55	~~NO~~ SO2	220.7	220.5	120					
Range/CS 250 220.7	56	~~NO~~ SO2	93.1	92.65		86.0	95.0	85.3	85.0	
Analyzer Model Ametek	05	N2	0.0	.12		3.1	1.8	2.9	3.7	
Analyzer SN: 4	51	SO2	51.7	50.6				1400		
TGOC ppm ch							21.76			
Range					recal		12.28	12.1		
Analyzer Model					CO_2		0.09	.04		
Analyzer SN:		Air								
ch										
Range/CS										

Chrome Testing
08/04/2009
Tedlar Bag Data

20)

Performance Specs: (25A)	Test Times	Run 1	Run 2	Run 3
5% (Cs-Cv) / Cv	Start Time	1225	~~1444~~ 1502	1659
5% (Cs-Cv) / Range	End Time	~~1342~~ 1339 JH	~~1541~~ 1606 JH	1755
3% (Csi-Csf) / Range				

*Alternate specification: 0.5 ppmv absolute difference

Test Notes: 69% RH

	O2	CO2
129 R1	15.42	4.27
R2	16.20	4.10
R3	16.42	3.43

D. Gregg
206-595-7675

1505 - Pt #1
1515 - P2 #2
1525 - P2 #3
Strat Check

Hot Line Temp 250
Hot Line Temp 250

Saint Gobain Furnace No. 4, Tedlar Bags August 5, 2009		Cylinder ID	Range	Cylinder Value Cv	Analyzer Calibration Response Cdir	Initial System Calibration Response Csi	Final System Calibration Response Csf	Cylinder Value Percent of Span	Analyzer Calibration Error < 2%	Initial System Bias < 5%	Final System Bias < 5%	Drift < 3%
OXYGEN												
Run 1	High Conc. (CS)	Ambient	25	20.95	20.90			100%	0.2%			
	Mid-Conc. High	O-5	25	11.61	11.80	11.62	11.63	55%	0.9%	-0.9%	-0.8%	0.0%
	Zero	22	25	0.00	0.00	0.03	0.04	0%	0.0%	0.1%	0.2%	0.0%
Run 2			25		20.90							
			25		11.80	11.63	11.65			-0.8%	-0.7%	0.1%
			25		0.00	0.04	0.00			0.2%	0.0%	0.2%
Run 3			25		20.90							
			25		11.80	11.65	11.59			-0.7%	-1.0%	0.3%
			25		0.00	0.00	0.00			0.0%	0.0%	0.0%
CARBON DIOXIDE												
Run 1	High Conc. (CS)	35	25	21.76	21.76			100%	0.0%			
	Mid-Conc. High	22	25	12.52	12.28	12.20	11.35	58%	1.1%	-0.4%	-4.3%	3.9%
	Mid-Conc. Low	12	25	5.97	5.96			27%	0.0%			
	Zero	O-5	25	0.00	-0.01	0.01	0.06	0%	0.0%	0.1%	0.3%	0.2%
Run 2			25		21.76							
			25		12.28	12.10	12.02			-0.8%	-1.2%	0.4%
			25		5.96							
			25		0.09	0.09	0.10			0.0%	0.0%	0.0%
Run 3			25		21.76							
			25		12.28	12.02	11.99			-1.2%	-1.3%	0.1%
			25		5.96							
			25		0.09	0.10	0.08			0.0%	-0.0%	0.1%

Part 60, Appendix A, Method 6C, Figures 6C-3 to 6C-5; Method 25A

Production/Process Data

Furnace Operating Data

Saint-Gobain Containers, Inc., Seattle Plant
Furnace Operating Data
August 4, 2009

Test Times	**8/4/2009**
Run 1	12:25-13:42
Run 2	14:41-16:06
Run 3	16:39-17:55
Run 4	NA
Run 5	NA
Furnace #	**4**
Pull Rate (Tons Glass/Day)	135.9
Gas (scfh)	34423
Oil (gal/hr) #2 Ultra-low Sulfer Diesel	0
Oxygen (scfh)	0
Air (scfh)	241000
Electric Boost (kW)	2736
Bridgewall Temp (F)	2830
Cullet Ratio (%)	50.7
Glass Color	CG

Calibration Information

Meter Box

Calibration Critical Orifices

Standard Meter

Pitots

Thermocouples and Indicators

Nozzle Diameters

Barometer

Calibration Gas Certificates

Biannual Meterbox Calibration

Method EPA M-5 #7.2
Location Horizon Shop
Meter Box ID 19
Meter ID
calibrated by PT

Date 8/3/09
Pb= 30.00 (in Hg)
Ta= 78 (oF)
Tamb 538 (oR)

Leak checks
Negative 0.0 in/min @ inches Hg
Positive in/min @ inches H20

0.97<Y<1.03	Old 1/7/09	New 8/3/09	Change (+/-)	
Y=	0.99612	0.99618	0.0%	pass
dH@=	1.87206	1.85111	-1.1%	

	VAC (in Hg)	Critical Orifice ID	K	dH (InH2O)	Meter (ft3)	Net (ft3)	Field Tdi (oF)	Meter Tdo (oF)	To (oR)	Tm (oR)	Time t (min)	Y	dH@	Y 0.020	dH@ 0.20	Allow. Tolerance
Initial	25.0	40.0	0.23610	0.32	231.6010	5.3990	82.0	82.0	543.0	542.5	17.25	0.99940	1.85119	0.003	0.00	
Final					237.0000		82.0	84.0						pass	pass	
Initial	18.0	73.0	0.80674	3.90	237.0000	8.4050	82.0	84.0	545.0	543.8	7.77	0.98132	1.88023	0.015	0.03	
Final					245.4050		83.0	86.0						pass	pass	
Initial	22.0	55.0	0.46086	1.20	245.4050	5.5950	83.0	86.0	548.0	545.8	9.20	1.00783	1.82190	0.012	0.03	
Final					251.0000		84.0	90.0						pass	pass	
												0.99618	1.85111	0.00595	0.01168	

Post Test Meterbox Calibration

Method	EPA M-5 #7.2
Location	Seattle, WA
Meter Box	19
calibrated by	WS

Date 08/05/2009
Pb= 30.00 (in Hg)
Ta= 75 (oF)
Tamb 535 (oR)

	Biannual 08/03/2009	Post-Test 08/05/2009	Change (+/-)	
Y=	0.99618	1.00498	0.9%	pass
dH@=	1.85111	1.80284	-2.7%	

	VAC (in Hg)	Critical Orifice ID	K	dH (inH2O)	Meter (ft3)	Net (ft3)	Field Meter Tdi (oF)	Tdo (oF)	To (oR)	Tm (oR)	Time t (min)	Y	dH@	Y 0.020	dH@ 0.20	Allow. Tolerance
Initial	21.5	56.0	0.47900	1.30	640.6750	5.0940	85.0	89.0	547.5	546.3	8.00	1.00392	1.78202	0.001	0.02	
Final .					645.7690		85.0	86.0						pass	pass	
Initial	21.5	56.0	0.47900	1.30	645.7690	5.2180	84.0	85.0	545.0	544.3	8.25	1.00699	1.81442	0.002	0.01	
Final					650.9870		83.0	85.0						pass	pass	
Initial	21.5	56.0	0.47900	1.30	650.9870	6.0180	83.0	84.0	544.0	543.5	9.50	1.00404	1.81209	0.001	0.01	
Final					657.0050		83.0	84.0						pass	pass	
												1.00498	1.80284	0.00080	0.00833	

Post Test M5 Meterbox Calibrations

Method	EPA M-5 #7.2	Date	8/5/09	
Location	Stack 4 St. Gobain	Pb=	30.0	(in Hg)
Meter Box	i9	Ta=	75	(oF)
Meter ID				
Calibrated by	WS	Leak Check Rate	0.000	in/min

	VAC (inHg)	Critical Orifice	K	dH inH2O	Meter (ft3)	Field Tdi (oF)	Meter Tdo (oF)	Time t (min)
Initial	21.5	56	0.47900	1.3	640.675	85	89	8:00
Final					645.769	85	86	
Initial	21.5	56	"	1.3	645.769	84	85	8:15
Final					650.987	83	85	
Initial	21.5	56	"	1.3	650.987	83	84	9:30
Final					657.005	83	84	

*If the box leaks or doesn't calibrate for any reason please let report writer know ASAP and document it.
Be sure to update new K values from annual calibrations when entering data into spreadsheet.
You must collect at least 5 cuft.
****For post-test calibrations in field (New 10.3.2, Old 5.3.2) Select orifice nearest to operational conditions
Make 3 runs of 5 cuft each.
Comments:

Method	EPA M-5 #7.2	Date		
Location		Pb=		(in Hg)
Meter Box		Ta=		(oF)
Meter ID				
Calibrated by		Leak Check Rate		in/min

	VAC (inHg)	Critical Orifice	K	dH inH2O	Meter (ft3)	Field Tdi (oF)	Meter Tdo (oF)	Time t (min)
Initial								
Final								
Initial								
Final								
Initial								
Final								

*If the box leaks or doesn't calibrate for any reason please let report writer know ASAP and document it.
Be sure to update new K values from annual calibrations when entering data into spreadsheet.
You must collect at least 5 cuft.
****For post-test calibrations in field (New 10.3.2, Old 5.3.2) Select orifice nearest to operational conditions
Make 3 runs of 5 cuft each.
Comments:

Critical Orifice Calibrations

Set	Shop			
Job #	in house			
Date:	6/23/09	7/6/09		
DGM (Y) =	0.99630			
DGM ID #	standard			
Calibrated by:	JKR	KRK	*** Minimum 5 minute Runs ***	

Horizon Engineering
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Dry Gas Meter			Orifice ID 73		Orifice ID 63		Orifice ID 55		Orifice ID 48		Orifice ID 40	
K' Critical Orifice Coefficient			0.80674		0.59036		0.46086		0.34656		0.23610	
	Symbol	Units	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2
Initial volume	Vi	ft^3	610.700	624.024	590.205	598.636	921.813	927.904	563.145	568.972	555.700	559.185
Final Volume	Vf	ft^3	624.024	636.805	598.636	610.613	927.904	934.010	568.972	574.526	559.185	563.145
Difference	Vm	ft^3	13.324	12.781	8.431	11.977	6.091	6.106	5.827	5.554	3.485	3.960
Temperatures												
Ambient		°F	72.0	72.0	72.0	72.0	70.0	70.0	72.0	72.0	72.0	72.0
Absolute ambient	Ta	°R	531.7	531.7	531.7	531.7	529.7	529.7	531.7	531.7	531.7	531.7
Initial Inlet	Ti	°F	88.4	92.4	84.2	89.6	79.0	80.0	80.4	81.4	78.6	79.4
Outlet	Tf	°F	81.2	82.6	79.6	80.4	73.0	74.0	76.2	77.2	74.6	75.4
Final Inlet	Ti	°F	98.0	97.8	91.6	92.2	81.0	82.0	82.4	83.2	79.6	80.6
Outlet	Tf	°F	82.8	83.6	80.6	81.6	74.0	74.0	77.4	78.0	75.4	76.4
Avg. Temp	Tm	°R	547.3	548.8	543.7	545.6	536.4	537.2	538.8	539.6	536.7	537.6
Time		min	12	11	10	15	10	10	12	12	11	12
		sec	21	49	41	10	0	0	40	3	8	40
			12.35	11.82	10.68	15.17	10.00	10.00	12.67	12.05	11.13	12.67
Orifice man. rdg	dH@	in H2O	4.200	4.200	2.200	2.200	1.300	1.300	0.690	0.690	0.300	0.290
Barometric. Pressure	Pbar	inHg	30.20	30.20	30.20	30.20	30.10	30.10	30.20	30.20	30.20	30.20
Pump vacuum		inHg	8.0	8.0	14.0	14.0	17.0	17.0	17.0	17.0	18.0	18.0
K' factor			0.80682	0.80666	0.59122	0.58950	0.46061	0.46110	0.34650	0.34662	0.23645	0.23575
K' factor Average				0.80674		0.59036		0.46086		0.34656		0.23610
% Error (+/- 0.5)		%		0.01%		0.15%		0.05%		0.02%		0.15%
Vcr(std)			13.0506	12.4845	8.2726	11.7100	6.0242	6.0306	5.7484	5.4705	3.4479	3.9112
Vm(std)			13.0991	12.5309	8.3033	11.7535	6.0466	6.0530	5.7698	5.4908	3.4607	3.9257
Y			0.9963	0.9963	0.9963	0.9963	0.9963	0.9963	0.9963	0.9963	0.9963	0.9963

Critical Orifice Calibrations

Set TV 4
Job # in house
Date: 6/28/09
DGM (Y) = 0.99630
DGM ID # standard
Calibrated by: JR

Horizon Engineering
13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

*** Minimum 5 minute Runs ***

Dry Gas Meter			Orifice ID #35		Orifice ID #44		Orifice ID #51		Orifice ID #56		Orifice ID #65	
K' Critical Orifice Coefficient			0.18151		0.29158		0.37467		0.47900		0.63628	
	Symbol	Units	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2
Initial volume	Vi	ft³	791.100	794.650	799.220	806.000	779.000	786.100	810.650	815.005	759.905	770.401
Final Volume	Vf	ft³	794.650	799.220	806.000	810.650	786.100	791.100	815.005	822.100	770.401	778.998
Difference	Vm	ft³	3.550	4.570	6.780	4.650	7.100	5.000	4.355	7.095	10.496	8.597
Temperatures												
Ambient		°F	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Absolute ambient	Ta	°R	529.7	529.7	529.7	529.7	529.7	529.7	529.7	529.7	529.7	529.7
Initial Inlet	Ti	°F	79.2	76.2	77.0	79.4	85.2	79.2	79.4	82.2	83.0	84.4
Outlet	Tf	°F	75.8	75.6	76.0	76.8	75.1	75.6	77.2	77.2	82.8	74.6
Final Inlet	Ti	°F	76.8	77.4	80.2	80.6	80.6	81.0	83.8	85.6	86.2	87.2
Outlet	Tf	°F	75.8	76.2	76.8	76.8	75.6	76.0	77.2	77.8	74.4	75.4
Avg. Temp	Tm	°R	536.6	536.0	537.2	538.1	538.8	537.6	539.1	540.4	541.3	540.1
Time		min	14	19	17	12	14	10	6	11	12	10
		sec	41	5	30	1	13	5	52	5	25	10
			14.68	19.08	17.50	12.02	14.22	10.08	6.87	11.08	12.42	10.17
Orifice man. rdg	dH@	in H2O	0.180	0.180	0.500	0.500	0.870	0.870	1.400	1.400	2.600	2.600
Barometric. Pressure	Pbar	inHg	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50	30.50
Pump vacuum		inHg	19.0	19.0	18.0	18.0	17.0	17.0	15.0	15.0	15.0	15.0
K' factor			0.18228	0.18074	0.29200	0.29116	0.37560	0.37375	0.47735	0.48065	0.63547	0.63710
K' factor Average				0.18151		0.29158		0.37467		0.47900		0.63628
% Error (+/- 0.5)		%		0.43%		0.14%		0.25%		0.34%		0.13%

Vcr(std)	3.5470	4.5708	6.7719	4.6367	7.0765	4.9943	4.3439	7.0599	10.4567	8.5839
Vm(std)	3.5602	4.5878	6.7971	4.6539	7.1028	5.0129	4.3600	7.0861	10.4956	8.6157
Y	0.9963	0.9963	0.9963	0.9963	0.9963	0.9963	0.9963	0.9963	0.9963	0.9963

HORIZON ENGINEERING LLC
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Standard Meter Calibration
ID# 2299046
Northwest Natural, Gas Meter Division

SET ☐	NEW METER NUMBER	SIZE	PERF #	NEW ERT#	INDEX READING
CHANGE ☐ REMOVAL ☐	OLD METER NUMBER	SIZE	OLD PERF #	OLD ERT#	OLD INDEX READING

SERVICE ADDRESS	SPACE OR APT NO.	CITY

METER LEFT ON / OFF	EQUIP LEFT ON / OFF	CURB LEFT ON / OFF	CUST VALVE ON / OFF	LOC.	INS.	BS.	BW.	PDL
GREEN TAG YES / NO	YELLOW TAG YES / NO	TIED / NOT TIED	MTR PRESSURE	6.5 INWC @ 130 CFH	2LB	OVER 2LB		

REMARKS Meter tested at 3 flow rates only.

Completed By: Date:

METER SAMPLE 1	WRONG SIZE 2	INDEX IMPAIRED 3	DR 4		METER IMPAIRED 6
ERT DAMAGE 7	LEAK 8	SET WRONG 14	LIQUIDS 15		DEMAND TEST 18
OTHER 19	CORROSION 20	NO USE 21	PCC 24	Unauthorized Gas/Vandalism 27	FIRE 28

← FOR METER CHANGES/ REMOVALS ONLY

↓ FOR METER SHOP ONLY ↓

COMMENTS/TEST CODES	INCOMING TESTS	
80% - 99.6	OPEN	
60% - 99.6	CHECK	
30% - 99.7	INDEX READ	ERT READ

TEST DATE	INITIALS	METER
6/9/09	JM	S-275

F-8735 METER RECORD (Rev 0807) PART 1

Date Mar-09
Method: #2 sec 4 WT
Location: Whitaker Shop

Pilot	Date Tested	Cp	S	Pilot	Date Tested	Cp	S	Pilot	Date Tested	Cp	S	Pilot	Date Tested	Cp	S
5-1	Not in use			5-11	3/17/2000	0.8345	0.003	6-1	3/11/09	0.8354	0.004	7-1	08/03/00		
5-2	3/18/00	0.8049	0.006	5-12	4/21/2000	0.8366	0.000	6-2	3/11/09	0.8238	0.004	7-2	03/18/00	0.8307	0.003
5-3	Not in use			5-13	6/8/2009	0.8376	0.002	6-3	3/11/09	0.8167	0.004	7-3	Not in use		
5-4	3/10/00	0.8385	0.000	5-14	6/8/2009	0.7926	0.004	6-4	Not in use			7-4	03/11/00	0.8213	0.001
5-5	3/10/09	0.8280	0.002	5-15	6/8/2000	0.8119	0.007	6-5	3/11/09	0.8256	0.003	7-5	03/10/00	0.8365	0.002
5-6	3/11/00	0.8289	0.002	5-16	6/8/2009	0.8135	0.007	6-6	3/10/09	0.8390	0.001	7-6	03/17/00	0.8384	0.001
5-7	3/10/00	0.8399	0.005	5-17	6/8/2009	0.8124	0.000					7-7	03/11/09	0.8341	0.002
5-8	3/18/00	0.8160	0.004	5-18	xx/xx/xx							7-8	03/17/09	0.8384	0.001
5-9	3/18/00	0.8251	0.002	5-19	6/8/2000	0.8154	0.005								
5-10	3/10/09	0.8353	0.003												

		DpP (P-Type)	DpS (S-Type)	Cp	dS	Ave Cp	S <0.01
	5-1						
Status							
Date	Not in use						
Tester	xx						
	5-2	0.310	0.480	0.7956	0.000	0.8049	0.006
Status	Pass	0.590	0.880	0.8106	0.006		
Date	3/18/2000	1.000	1.500	0.8083	0.003		
Tester	JR						
	5-3						
Status							
Date	Not in use						
Tester	xx						
	5-4	0.320	0.450	0.8348	0.004	0.8388	0.006
Status	Pass	0.630	0.801	0.8408	0.006		
Date	3/10/2009	1.100	1.560	0.8340	0.005		
Tester	PS						
	5-5	0.330	0.470	0.8298	0.002	0.8280	0.002
Status	Pass	0.640	0.920	0.8257	0.002		
Date	3/10/2000	1.100	1.570	0.8267	0.001		
Tester	PS						
	5-6	0.325	0.460	0.8321	0.003	0.8289	0.002
Status	Pass	0.630	0.900	0.8283	0.001		
Date	3/11/2000	1.080	1.550	0.8264	0.003		
Tester	PS						
	5-7	0.330	0.460	0.8365	0.001	0.8399	0.005
Status	Pass	0.640	0.876	0.8467	0.007		
Date	3/10/2009	1.080	1.520	0.8345	0.005		
Tester	PS						
	5-8	0.315	0.470	0.8105	0.000	0.8160	0.004
Status	Pass	0.600	0.885	0.8152	0.001		
Date	3/18/2009	0.980	1.420	0.8224	0.008		
Tester	JR						
	5-9	0.320	0.460	0.8257	0.001	0.8251	0.002
Status	Pass	0.580	0.830	0.8276	0.002		
Date	3/18/2000	1.000	1.460	0.8222	0.003		
Tester	JR						
	5-10	0.330	0.465	0.8340	0.001	0.8353	0.003
Status	Pass	0.640	0.905	0.8326	0.003		
Date	3/10/2009	1.100	1.530	0.8394	0.004		
Tester	PS						
	5-11	0.345	0.463	0.8367	0.002	0.8345	0.003
Status	Pass	0.640	0.910	0.8302	0.004		
Date	3/17/2000	1.000	1.400	0.8367	0.002		
Tester	JSL						
	5-12	0.330	0.460	0.8385	0.002	0.8366	0.000
Status	Pass	0.600	0.910	0.8431	0.006		
Date	4/21/2000	1.050	1.500	0.8283	0.008		
Tester	PW						
	5-13	0.330	0.460	0.8365	0.001	0.8376	0.002
Status	Pass	0.645	0.895	0.8404	0.003		
Date	4/21/2009	1.050	1.480	0.8339	0.004		
Tester	PW						
	5-14	0.410	0.630	0.7987	0.006	0.7926	0.004
Status	Pass	0.530	0.835	0.7887	0.004		
Date	6/8/2009	0.765	1.200	0.7905	0.002		
Tester	PW						
	5-15	0.380	0.550	0.8229	0.011	0.8119	0.007
Status	Pass	0.610	0.910	0.8105	0.001		
Date	6/8/2009	0.755	1.150	0.8022	0.010		
Tester	PW						
	5-16	0.405	0.600	0.8202	0.007	0.8135	0.007
Status	Pass	0.600	0.880	0.8176	0.004		
Date	6/6/2009	0.855	1.300	0.8020	0.011		
Tester	PW						
	5-17	0.375	0.545	0.8212	0.009	0.8124	0.009
Status	Pass	0.580	0.850	0.8178	0.005		
Date	6/8/2009	0.845	1.300	0.7982	0.014		
Tester	PW						
	5-19	0.320	0.480	0.8083	0.007	0.8154	0.005
Status	Pass	0.640	0.940	0.8169	0.002		
Date	6/8/2000	1.100	1.600	0.8209	0.006		
Tester	PS						

		DpP (P-Type)	DpS (S-Type)	Cp	dS	Ave Cp	S <0.01
	6-1	0.330	0.470	0.8296	0.000	0.8354	0.004
Status	Pass	0.640	0.895	0.8372	0.002		
Date	3/11/2009	1.100	1.530	0.8394	0.004		
Tester	PS						
	6-2	0.330	0.475	0.8252	0.001	0.8238	0.004
Status	Pass	0.640	0.915	0.8280	0.004		
Date	3/11/2009	1.100	1.610	0.8183	0.006		
Tester	PS						
	6-3	0.330	0.480	0.8200	0.006	0.8167	0.004
Status	Pass	0.650	0.970	0.8104	0.006		
Date	3/11/2009	1.100	1.620	0.8168	0.000		
Tester	PS						
	6-4						
Status							
Date	Not in use						
Tester	xx						
	6-5	0.330	0.470	0.8296	0.004	0.8256	0.003
Status	Pass	0.642	0.930	0.8225	0.003		
Date	3/11/2009	1.110	1.600	0.8246	0.001		
Tester	PS						
	6-6	0.330	0.460	0.8385	0.000	0.8390	0.001
Status	Pass	0.630	0.876	0.8400	0.001		
Date	3/10/2009	1.040	1.450	0.8384	0.001		
Tester	PS						
	7-1	0.300	0.450	0.8083	0.007	0.8153	0.005
Status	Pass	0.600	0.870	0.8222	0.007		
Date	8/3/2009	0.950	1.400	0.8155	0.000		
Tester	NY						
	7-2	0.310	0.430	0.8406	0.001	0.8397	0.003
Status	Pass	0.610	0.840	0.8436	0.004		
Date	3/18/2009	0.960	1.350	0.8348	0.005		
Tester	JR						
	7-3						
Status							
Date	Not in use						
Tester	xx						
	7-4	0.327	0.477	0.8197	0.002	0.8213	0.001
Status	Pass	0.650	0.940	0.8232	0.002		
Date	3/11/2009	1.100	1.600	0.8209	0.000		
Tester	PS						
	7-5	0.320	0.450	0.8348	0.004	0.8365	0.002
Status	Pass	0.620	0.880	0.8406	0.002		
Date	3/10/2009	1.080	1.500	0.8400	0.002		
Tester	PS						
	7-6	0.318	0.442	0.8397	0.001	0.8384	0.001
Status	Pass	0.610	0.850	0.8387	0.000		
Date	3/17/2009	1.000	1.400	0.8367	0.002		
Tester	JSL						
	7-7	0.330	0.465	0.8340	0.000	0.8341	0.002
Status	Pass	0.637	0.905	0.8306	0.004		
Date	3/11/2009	1.110	1.550	0.8378	0.004		
Tester	PS						
	7-8	0.318	0.442	0.8397	0.001	0.8384	0.001
Status	Pass	0.610	0.850	0.8387	0.000		
Date	3/17/2009	1.000	1.400	0.8367	0.002		
Tester	JSL						

Month: February/March			Testers: PS/NY			Location: Horizon Shop								
			Ambient			220 +/-			400 +/-					
	Probe/ID	Date	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %	Amb.	220	400
Probe	3-1	2/2/09	59.0	60.0	-0.19%	214.0	216.0	-0.15%	406.0	411.0	-0.58%	pass	pass	pass
Probe	3-2	TC detached			0.00%			0.00%			0.00%			
Probe	3-3	3/11/09	61.0	60.0	0.19%	228.0	228.0	0.00%	401.0	400.0	0.12%	pass	pass	pass
Probe	3-4	3/11/09	60.0	60.0	0.00%	227.0	227.0	0.00%	406.0	405.0	0.12%	pass	pass	pass
Probe	3-5	2/2/09	62.0	62.0	0.00%	216.0	217.0	-0.15%	398.0	399.0	-0.12%	pass	pass	pass
Probe	3-6	2/2/09	61.0	60.0	0.19%	214.0	223.0	-1.34%	445.0	444.0	0.11%	pass	pass	pass
Probe	3-7	TC Detached			0.00%			0.00%			0.00%			
Probe	3-8	2/3/09	60.0	60.0	0.00%	210.0	215.0	-0.76%	423.0	430.0	-0.79%	pass	pass	pass
Probe	3-9	not in use			0.00%			0.00%			0.00%			
Probe	3-10	2/3/09	60.0	61.0	-0.19%	200.0	203.0	-0.45%	399.0	403.0	-0.47%	pass	pass	pass
Probe	3-11	3/11/09	59.0	59.0	0.00%	231.0	230.0	0.14%	398.0	398.0	0.00%	pass	pass	pass
Probe	3-12	not in use			0.00%			0.00%			0.00%			
Probe	3-13	6/5/2009	75.1	75.0	0.02%	236.0	234.0	0.57%	440.0	441.0	-0.11%	pass	pass	pass
Probe	3-14	6/5/2009	75.3	75.1	0.04%	262.0	265.0	-0.42%	438.0	440.0	-0.45%	pass	pass	pass
Probe	4-1	3/11/09	59.0	59.0	0.00%	220.0	220.0	0.00%	408.0	407.0	0.12%	pass	pass	pass
Probe	4-2	2/6/09	60.0	61.0	-0.19%	229.0	230.0	-0.15%	415.0	420.0	-0.57%	pass	pass	pass
Probe	4-3	2/10/09	58.0	58.0	0.00%	204.0	210.0	-0.90%	396.0	393.0	0.35%	pass	pass	pass
Probe	4-4	2/10/09	58.0	58.0	0.00%	219.0	225.0	-0.86%	390.0	391.0	-0.12%	pass	pass	pass
Probe	4-5	2/10/09	58.0	57.0	0.19%	209.0	211.0	-0.30%	440.0	449.0	-1.00%	pass	pass	pass
Probe	4-6	2/6/09	62.0	62.0	0.00%	214.0	218.0	-0.74%	411.0	410.0	0.11%	pass	pass	pass
Probe	4-7	2/10/09	58.0	58.0	0.00%	200.0	200.0	0.00%	410.0	420.0	-1.15%	pass	pass	pass
Probe	4-8	2/4/09	61.0	60.0	0.19%	224.0	223.0	0.15%	398.0	396.0	0.23%	pass	pass	pass
Probe	4-9	3/11/09	59.0	59.0	0.00%	220.0	220.0	0.00%	410.0	410.0	0.00%	pass	pass	pass
Probe	4-10	2/10/09	64.0	63.0	0.19%	218.0	226.0	-1.18%	410.0	402.0	0.92%	pass	pass	pass
Probe	4-11	TC Detached			0.00%			0.00%			0.00%			
Probe	4-12	TC Detached			0.00%			0.00%			0.00%			
Probe	4-13	3/11/09	61.0	60.0	0.19%	221.0	219.0	0.20%	402.0	400.0	0.23%	pass	pass	pass
Probe	5-1	not in use			0.00%			0.00%			0.00%			
Probe	5-2	3/11/09	60.0	60.0	0.00%	216.0	220.0	-0.30%	410.0	411.0	-0.11%	pass	pass	pass
Probe	5-3	not in use			0.00%			0.00%			0.00%			
Probe	5-4	2/9/09	59.0	59.0	0.00%	204.0	206.0	-0.30%	403.0	408.0	-0.70%	pass	pass	pass
Probe	5-5	3/11/09	60.0	61.0	-0.19%	219.0	219.0	0.00%	401.0	405.0	-0.46%	pass	pass	pass
Probe	5-6	2/9/09	59.0	59.0	0.00%	212.0	216.0	-0.60%	405.0	405.0	0.00%	pass	pass	pass
Probe	5-7	2/9/09	58.0	58.0	0.00%	205.0	202.0	0.45%	388.0	395.0	-0.83%	pass	pass	pass
Probe	5-8	2/10/09	58.0	58.0	0.00%	208.0	212.0	-0.90%	396.0	399.0	-0.35%	pass	pass	pass
Probe	5-9	5/8/09	67.0	67.0	0.00%	231.0	230.0	0.14%	437.0	439.0	-0.22%	pass	pass	pass
Probe	5-10	3/11/09	60.0	60.0	0.00%	219.0	219.0	0.00%	401.0	405.0	-0.46%	pass	pass	pass
Probe	5-11	TC detached			0.00%			0.00%			0.00%			
Probe	5-12	4/21/2009	70.0	69.0	0.19%	221.0	223.0	-0.29%	410.0	408.0	0.23%	pass	pass	pass
Probe	5-13	4/21/2009	70.0	69.0	0.19%	215.0	219.0	-0.69%	396.0	398.0	-0.23%	pass	pass	pass
Probe	5-14	6/5/2009	72.0	72.2	-0.04%	261.0	256.0	0.42%	360.0	358.0	0.24%	pass	pass	pass
Probe	5-15	6/5/2009	72.4	73.4	-0.19%	230.4	230.8	-0.06%	408.0	408.2	-0.02%	pass	pass	pass
Probe	5-16	6/5/2009	75.4	76.6	-0.22%	204.4	204.8	-0.06%	408.6	409.4	-0.09%	pass	pass	pass
Probe	5-17	6/5/2009	75.0	75.0	0.00%	265.0	267.0	-0.26%	402.0	403.0	-0.12%	pass	pass	pass
Probe	6-1	2/9/09	61.0	58.0	0.58%	199.0	204.0	-0.76%	405.0	406.0	-0.12%	pass	pass	pass
Probe	6-2	3/11/09	59.0	59.0	0.00%	220.0	220.0	0.00%	390.0	389.0	0.12%	pass	pass	pass
Probe	6-3	2/9/09	60.0	57.0	0.58%	232.0	226.0	0.58%	412.0	420.0	-0.92%	pass	pass	pass
Probe	6-4	not in use			0.00%			0.00%			0.00%			
Probe	6-5	3/11/09	60.0	61.0	-0.19%	223.0	220.0	0.44%	410.0	411.0	-0.11%	pass	pass	pass
Probe	6-6	2/13/09	59.0	60.0	-0.19%	193.0	197.0	-0.61%	401.0	406.0	-0.58%	pass	pass	pass
Probe	7-1	3/11/09	59.0	59.0	0.00%	221.0	220.0	0.15%	383.0	385.0	-0.24%	pass	pass	pass
Probe	7-2	2/9/09	60.0	57.0	0.58%	233.0	240.0	-1.01%	427.0	419.0	0.90%	pass	pass	pass
Probe	7-3	not in use			0.00%			0.00%			0.00%			
Probe	7-4	2/9/09	61.0	58.0	0.58%	203.0	204.0	-0.15%	405.0	415.0	-1.16%	pass	pass	pass
Probe	7-5	2/9/09	60.0	57.0	0.58%	218.0	211.0	1.03%	388.0	385.0	0.12%	pass	pass	pass
Probe	7-6	2/9/09	60.0	57.0	0.58%	199.0	205.0	-0.91%	385.0	383.0	0.24%	pass	pass	pass
Probe	7-7	5/5/09	62.0	62.0	0.00%	208.0	208.0	0.00%	410.0	411.0	-0.11%	pass	pass	pass
Probe	7-8	2/9/09	60.0	57.0	0.58%	206.0	202.0	0.60%	380.0	386.0	-0.71%	pass	pass	pass
Probe	8-1				0.00%			0.00%			0.00%			
Probe	8-2	2/9/09	60.0	58.0	0.38%	209.0	206.0	0.45%	409.0	422.0	-1.50%	pass	pass	pass
Probe	9-1	not in use			0.00%			0.00%			0.00%			
Probe	9-2	not in use			0.00%			0.00%			0.00%			
Probe	10-1	2/12/09	66.0	65.0	0.19%	217.0	222.0	-0.74%	379.0	389.0	-1.19%	pass	pass	pass
Probe	10-2	2/13/09	58.0	59.0	-0.19%	199.0	198.0	0.15%	400.0	410.0	-1.16%	pass	pass	pass
Probe	10-3	not in use			0.00%			0.00%			0.00%			
Probe	10-4	not in use			0.00%			0.00%			0.00%			
Probe	10-5	2/13/09	58.0	59.0	-0.19%	208.0	204.0	0.60%	378.0	370.0	0.96%	pass	pass	pass
Probe	10-6	not in use	69.0	68.4	0.11%	230.0	228.0	0.28%	404.0	392.0	1.39%	pass	pass	pass
Probe	10-7	3/11/09	60.0	61.0	-0.19%	223.0	222.0	0.15%	390.0	391.0	-0.12%	pass	pass	pass
Probe	10-8	not in use			0.00%			0.00%			0.00%			
Probe	11-1	2/12/09	58.0	57.0	0.19%	194.0	196.0	-0.61%	383.0	394.0	-1.31%	pass	pass	pass
Probe	11-2	not in use			0.00%			0.00%			0.00%			
FS Pilot	7s-1	not in use			0.00%			0.00%			0.00%			
FS Pilot	10-S	3/11/09	60.0	61.0	-0.19%	219.0	221.0	-0.29%	386.0	386.0	0.24%	pass	pass	pass
FS Pilot	14s-1	3/11/09	60.0	60.0	0.00%	226.0	229.0	-0.44%	389.0	387.0	0.24%	pass	pass	pass
FS Pilot	14s-2	3/11/09	60.0	61.0	-0.19%	220.0	228.0	-1.18%	395.0	396.0	-0.12%	pass	pass	pass
Gas Probe TC	1	3/11/09	60.0	61.0	-0.19%	229.0	225.0	0.58%	407.0	405.0	0.23%	pass	pass	pass
Gas Probe TC	2	3/20/09	66.0	66.0	0.00%	230.0	232.0	-0.29%	416.0	415.0	0.11%	pass	pass	pass
Gas Probe TC	3	3/12/09	60.0	60.0	0.00%	210.0	211.0	-0.15%	401.0	400.0	0.12%	pass	pass	pass
FS Thermocouple	A2	3/12/09	61.0	60.0	0.19%	227.0	225.0	0.29%	399.0	398.0	0.12%	pass	pass	pass
FS Thermocouple	A4	3/12/09	60.0	60.0	0.00%	219.0	216.0	0.15%	383.0	385.0	-0.24%	pass	pass	pass
FS Thermocouple	A10	3/12/09	60.0	60.0	0.00%	227.0	225.0	0.29%	413.0	412.0	0.11%	pass	pass	pass
FS Thermocouple	A11	3/12/09	60.0	61.0	-0.19%	220.0	222.0	-0.28%	404.0	405.0	-0.12%	pass	pass	pass
FS Thermocouple	B17	3/12/09	61.0	62.0	-0.19%	225.0	225.0	0.00%	398.0	395.0	0.35%	pass	pass	pass
FS Thermocouple	B19				0.00%			0.00%			0.00%			
FS Thermocouple	F3	3/12/09	61.0	62.0	-0.19%	220.0	221.0	-0.15%	405.0	405.0	0.00%	pass	pass	pass
FS Thermocouple	F12	not in use			0.00%			0.00%			0.00%			
FS Thermocouple	F14	3/12/09	60.0	60.0	0.00%	219.0	221.0	-0.29%	410.0	409.0	0.11%	pass	pass	pass
FS Thermocouple	F73				0.00%			0.00%			0.00%			
FS Thermocouple	F85				0.00%			0.00%			0.00%			
FS Thermocouple	P2	3/12/09	60.0	58.0	0.38%	218.0	220.0	-0.30%	401.0	401.0	0.00%	pass	pass	pass
FS Thermocouple	P3	3/12/09	61.0	61.0	0.00%	221.0	220.0	0.15%	400.0	401.0	-0.12%	pass	pass	pass
FS Thermocouple	P4	3/12/09	60.0	60.0	0.00%	223.0	227.0	-0.59%	418.0	415.0	0.34%	pass	pass	pass
FS Thermocouple	P6				0.00%			0.00%			0.00%			

Standard Thermocouples (SN#)

Month: July/August		Testers: PS, PTH, JMH, KRK				Location: Horizon Shop				
Thermocouple		Ambient			220 +/-			400 +/-		
Indicator	Channel	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %
Meter Box 4	STACK	75	74	0.19%	200	201	-0.15%	400	401	-0.12%
8/3/2009	PROBE	75	77	-0.37%	200	201	-0.15%	400	401	-0.12%
	FILTER	75	75	0.00%	200	202	-0.30%	400	401	-0.12%
	IMPINGER	75	75	0.00%	200	201	-0.15%	400	400.4	-0.05%
	METER IN	75	76.6	-0.30%	200	201.5	-0.23%	400	402	-0.23%
	METER OUT	75	77	-0.37%	200	200.9	-0.14%	400	400.6	-0.07%
Meter Box 5	STACK	100	97	0.54%	200	198	0.30%	400	397	0.35%
8/3/2009	PROBE	100	96	0.71%	200	198	0.30%	400	395	0.58%
	FILTER	100	98	0.36%	200	197	0.45%	400	395	0.58%
	IMPINGER	100	99	0.18%	200	201	-0.15%	400	400	0.00%
	AUX	100	103	-0.54%	200	206	-0.91%	400	404	-0.47%
	METER IN	100	99	0.18%	200	198	0.30%	400	400	0.00%
	METER OUT	100	101	-0.18%	200	201	-0.15%	400	403	-0.35%
Meter Box 6	STACK	100	100.6	-0.11%	200	200.6	-0.09%	400	400.7	-0.08%
8/3/2009	PROBE	100	101.3	-0.23%	200	201.6	-0.24%	400	402	-0.23%
	FILTER	100	101.4	-0.25%	200	201.1	-0.17%	400	401	-0.12%
	IMPINGER	100	100.4	-0.07%	200	200.3	-0.05%	400	400.3	-0.03%
	METER IN	100	100.3	-0.05%	200	200.2	-0.03%	400	400.3	-0.03%
	METER OUT	100	100	0.00%	200	200.2	-0.03%	400	399.7	0.03%
Meter Box 7	STACK	75		14.03%	200		30.32%	400		46.53%
	PROBE	75		14.03%	200		30.32%	400		46.53%
	FILTER	75		14.03%	200		30.32%	400		46.53%
	IMPINGER	75		14.03%	200		30.32%	400		46.53%
	AUX	75		14.03%	200		30.32%	400		46.53%
	METER IN	75		14.03%	200		30.32%	400		46.53%
	METER OUT	75		14.03%	200		30.32%	400		46.53%
Meter Box 8	STACK	75	75	0.00%	200	199	0.15%	400	399	0.12%
7/7/2009	PROBE	75	74	0.19%	200	200	0.00%	400	400	0.00%
	FILTER	75	75	0.00%	200	200	0.00%	400	400	0.00%
	IMPINGER	75	74	0.19%	200	199	0.15%	400	399	0.12%
	AUX	75	75	0.00%	200	199	0.15%	400	399	0.12%
	METER IN	75	75	0.00%	200	199	0.15%	400	399	0.12%
	METER OUT	75	75	0.00%	200	199	0.15%	400	399	0.12%
Meter Box 9	STACK	100	96	0.71%	200	198	0.30%	400	396	0.47%
8/3/2009	PROBE	100	96	0.71%	200	198	0.30%	400	396	0.47%
	FILTER	100	97	0.54%	200	198	0.30%	400	396	0.47%
	IMPINGER	100	96	0.71%	200	198	0.30%	400	396	0.47%
	AUX	100	97	0.54%	200	198	0.30%	400	396	0.47%
	METER IN	100	97	0.54%	200	198	0.30%	400	396	0.47%
	METER OUT	100	97	0.54%	200	198	0.30%	400	396	0.47%
Meter Box 13	STACK	100	101	-0.18%	200	201	-0.15%	400	401	-0.12%
8/19/2009	PROBE	100	99	0.18%	200	200	0.00%	400	399	0.12%
	FILTER	100	101	-0.18%	200	200	0.00%	400	400	0.00%
	IMPINGER	100	102	-0.36%	200	202	-0.30%	400	401	-0.12%
	AUX	100	101	-0.18%	200	201	-0.15%	400	401	-0.12%
	METER IN	100	101	-0.18%	200	201	-0.15%	400	401	-0.12%
	METER OUT	100	101	-0.18%	200	201	-0.15%	400	401	-0.12%
Meter Box 14	STACK	75	74	0.19%	225	225	0.00%	400	398	0.23%
7/13/2009	PROBE	75	75	0.00%	200	201	-0.15%	400	399	0.12%
	FILTER	75	72	0.56%	200	197	0.45%	400	396	0.47%
	IMPINGER	75	74	0.19%	200	199	0.15%	400	399	0.12%
	AUX	75	75	0.00%	200	200	0.00%	400	398	0.23%
	METER IN	75	74	0.19%	200	199	0.15%	400	398	0.23%
	METER OUT	75	74	0.19%	200	199	0.15%	400	398	0.23%
Liter Meter 15	Probe	100	101	-0.18%	200	202	-0.30%	400	401	-0.12%
8/10/2009	Filter	100	101	-0.18%	200	202	-0.30%	400	403	-0.35%
	Aux-1	100	103	-0.54%	200	204	-0.61%	400	403	-0.35%
	Aux-2	100	103	-0.54%	200	204	-0.61%	400	404	-0.47%
	METER IN	100	103	-0.54%	200	204	-0.61%	400	403	-0.35%
	METER OUT	100	103	-0.54%	200	204	-0.61%	400	404	-0.47%
Liter Meter 16	Probe	100	102	-0.36%	200	201	-0.15%	400	401	-0.12%
8/10/2009	Filter	100	99	0.18%	200	199	0.15%	400	400	0.00%
	Aux-1	100	103	-0.54%	200	204	-0.61%	400	404	-0.47%
	Aux-2	100	103	-0.54%	200	204	-0.61%	400	404	-0.47%
	METER IN	100	100	0.00%	200	201	-0.15%	400	400	0.00%
	METER OUT	100	100	0.00%	200	201	-0.15%	400	400	0.00%
Liter Meter 17	Probe	100	99	0.18%	200	200	0.00%	400	399	0.12%
8/10/2009	Filter	100	101	-0.18%	200	202	-0.30%	400	401	-0.12%
	Aux-1	100	102	-0.36%	200	203	-0.45%	400	402	-0.23%
	Aux-2	100	102	-0.36%	200	203	-0.45%	400	402	-0.23%
	METER IN	100	101	-0.18%	200	203	-0.45%	400	403	-0.35%
	METER OUT	100		17.67%	200	202	-0.30%	400	402	-0.23%
Meter Box 19	STACK	100	101	-0.18%	200	202	-0.30%	400	400	0.00%
8/18/2009	PROBE	100	100	0.00%	200	201	-0.15%	400	401	-0.12%
	FILTER	100	100	0.00%	200	200	0.00%	400	400	0.00%
	IMPINGER	100	100	0.00%	200	202	-0.30%	400	400	0.00%
	AUX	100	102	-0.36%	200	202	-0.30%	400	400	0.00%
	METER IN	100	100	0.00%	200	202	-0.30%	400	401	-0.12%
	METER OUT	100	100	0.00%	200	201	-0.15%	400	399	0.12%
Fluke 074	1			0.00%			0.00%			0.00%
	2			0.00%			0.00%			0.00%
Fluke 197	1			0.00%			0.00%			0.00%
	2			0.00%			0.00%			0.00%
Fluke 198	1			0.00%			0.00%			0.00%
	2			0.00%			0.00%			0.00%
Fluke 227	1			0.00%			0.00%			0.00%
	2			0.00%			0.00%			0.00%
Fluke 228	1			0.00%			0.00%			0.00%
	2			0.00%			0.00%			0.00%

Thermocouple Calibrations

	Testers: ps, ny			Location: Horizon Shop		
	Ambient			Heated		
Meterbox	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %
4 In	64.0	65.0	-0.19%	245.0	246.0	-0.14%
1/7/09 Out	64.0	65.0	-0.19%	260.0	261.0	-0.14%
5 In	62.0	63.0	-0.19%	210.0	212.0	-0.30%
1/8/09 Out	63.0	64.0	-0.19%	186.0	186.0	0.00%
6 In	64.0	64.0	0.00%	239.0	238.0	0.14%
1/7/09 Out	65.0	65.0	0.00%	225.0	224.0	0.15%
7 In	62.0	61.0	0.19%	265.0	265.0	0.00%
1/7/09 Out	62.0	61.0	0.19%	265.0	264.0	0.14%
8 In	65.0	66.0	-0.19%	240.0	239.0	0.14%
1/7/09 Out	64.0	63.0	0.19%	237.0	236.0	0.14%
9 In	62.0	62.0	0.00%	222.0	222.0	0.00%
1/7/09 Out	63.0	63.0	0.00%	223.0	223.0	0.00%
13 In	63.0	64.0	-0.19%	260.0	258.0	0.28%
1/7/09 Out	64.0	64.0	0.00%	260.0	260.0	0.00%
14 In	61.0	60.0	0.19%	227.0	227.0	0.00%
1/7/09 Out	65.0	64.0	0.19%	218.0	218.0	0.00%
19 In	64.0	65.0	-0.19%	207.0	207.0	0.00%
1/7/09 Out	64.0	64.0	0.00%	218.0	218.0	0.00%
	Ambient			Heated		
Liter Meter	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %
15 In	62.0	62.0	0.00%	188.0	188.0	0.00%
1/8/09 Out	64.0	64.0	0.00%	228.0	228.0	0.00%
16 In	63.0	63.0	0.00%	206.0	205.0	0.15%
1/8/09 Out	64.0	65.0	-0.19%	231.0	231.0	0.00%
17 In	63.0	63.0	0.00%	256.0	254.0	0.28%
1/8/09 Out	64.0	65.0	-0.19%	207.0	206.0	0.15%
Standard TCs (SN#)	T 1001-1	200602	200701	200702	200703	

		Testers:			Location:					
		Ambient			High (200 +/-)			Ice		
	Date	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %
Sample Box - impinger out										
017	3/11/2009	60.0	60.0	0.00%	x	x		32.0	31.0	0.20%
018	3/11/2009	60.0	60.0	0.00%	x	x		32.0	32.0	0.00%
019	3/11/2009	60.0	60.0	0.00%	x	x		32.0	32.0	0.00%
020	3/11/2009	60.0	60.0	0.00%	x	x		32.0	32.0	0.00%
TRS 156				0.00%	x	x				0.00%
172	3/11/2009	60.0	60.0	0.00%	x	x		32.0	32.0	0.00%
173	3/11/2009	60.0	60.0	0.00%	x	x		32.0	32.0	0.00%
184	3/11/2009	60.0	59.0	0.19%	x	x		32.0	32.0	0.00%
185	3/11/2009	60.0	60.0	0.00%	x	x		32.0	33.0	-0.20%
186	3/11/2009	60.0	60.0	0.00%	x	x		32.0	32.0	0.00%
187	3/11/2009	60.0	60.0	0.00%	x	x		32.0	33.0	-0.20%
188	3/11/2009	60.0	60.0	0.00%	x	x		32.0	33.0	-0.20%
189	3/11/2009	60.0	60.0	0.00%	x	x		32.0	32.0	0.00%
TRS 190				0.00%	x	x				0.00%
229	3/11/2009	60.0	60.0	0.00%	x	x		32.0	32.0	0.00%
230	3/11/2009	60.0	60.0	0.00%	x	x		32.0	32.0	0.00%
327	3/11/2009	60.0	59.0	0.19%	x	x		32.0	31.0	0.20%
328	3/11/2009	60.0	60.0	0.00%	x	x		32.0	32.0	0.00%
329	3/11/2009	60.0	60.0	0.00%	x	x		32.0	32.0	0.00%
331	3/11/2009	60.0	59.0	0.19%	x	x		32.0	32.0	0.00%
Sample Box - oven										
017	3/11/2009	60.0	61.0	-0.19%	210.0	211.0	-0.15%	x	x	
		60.0	60.0	0.00%	211.0	211.0	0.00%	x	x	
019	3/11/2009	60.0	62.0	-0.38%	210.0	216.0	-0.90%	x	x	
020	3/11/2009	60.0	60.0	0.00%	206.0	208.0	-0.30%	x	x	
156	3/11/2009	60.0	60.0	0.00%	202.0	206.0	-0.60%	x	x	
172	3/11/2009	60.0	63.0	-0.58%	211.0	208.0	0.45%	x	x	
173	3/11/2009	60.0	60.0	0.00%	210.0	215.0	-0.75%	x	x	
184	3/11/2009	60.0	60.0	0.00%	202.0	200.0	0.30%	x	x	
185	3/11/2009	60.0	60.0	0.00%	195.0	198.0	-0.46%	x	x	
186	3/11/2009	60.0	59.0	0.19%	199.0	201.0	-0.30%	x	x	
187	3/11/2009	60.0	58.0	0.38%	207.0	207.0	0.00%	x	x	
188	3/11/2009	60.0	60.0	0.00%	210.0	210.0	0.00%	x	x	
189	3/11/2009	60.0	61.0	-0.19%	212.0	212.0	0.00%	x	x	
190	3/11/2009	60.0	60.0	0.00%	208.0	208.0	0.00%	x	x	
229	3/11/2009	60.0	60.0	0.00%	210.0	210.0	0.00%	x	x	
230	3/11/2009	60.0	60.0	0.00%	213.0	213.0	0.00%	x	x	
327	3/11/2009	60.0	60.0	0.00%	204.0	207.0	-0.45%	x	x	
328	3/11/2009	60.0	60.0	0.00%	200.0	203.0	-0.45%	x	x	
329	3/11/2009	60.0	60.0	0.00%	207.0	206.0	0.15%	x	x	
331	3/11/2009	60.0	60.0	0.00%	209.0	210.0	-0.15%	x	x	

Standard Thermocouples (SN#) T 1001-1 200602 200701 200702 200703

Grant Edgel Company — MFG. RED COMET OVENS

TELEPHONE 254-6524 (AREA CODE 503)

4233 N.E. 147TH AVENUE • P.O. BOX 20116 • PORTLAND, OREGON 97220

LABORATORY PRIMARY STANDARDS

CERTIFICATE

FOR

Type K Thermocouple

1/4" x 36" w/plug

Serial# 200701, 200702, 200703

GRANT EDGEL PRIMARY STANDARDS LABORATORY

ID NO.

DATE

NEXT

BY

Submitted By

Horizon Engineering

13585 NE Whittaker Way

Portland, OR 97230

LABORATORY PRIMARY STANDARDS

T/C #	32°F	212°F
200701	+.9	-1.3
200702	+.3	-1.0
200703	+.5	-.9

Certified By: Fluke Model 724 Serial# 9806098
Resubmission Date: 11-18-09

The accuracy stated on this certificate is traceable to the NATIONAL BUREAU OF STANDARDS through certification documents on file in the Metrology Laboratory of the Grant Edgel Company.

Test Conditions	
AMBIENT TEMP.:	68°F
REL. HUMIDITY:	45%
DATE:	6-4-09
REPORT NO.:	09F-4
SERVICE ORDER:	20507
P.O. NUMBER:	

Authorized Signatures

PERFORMED BY: RG

APPROVED BY: Bob Edgel

RESUBMISSION DATE: 6-4-10

A Satisfied Customer is Our First Consideration

Grant Edgel Company — MFG. RED COMET OVENS
TELEPHONE 254-6524 (AREA CODE 503)
4233 N. E. 147TH AVENUE • P. O. BOX 20116 • PORTLAND, OREGON 97220

LABORATORY PRIMARY STANDARDS

CERTIFICATE

FOR

Type K Thermocouple
1/8" x 3" w/plug
Serial# 200602

GRANT EDGEL PRIMARY STANDARDS LABORATORY
ID NO
DATE
NEXT
BY

Submitted By

Horizon Engineering
13585 NE Whittaker Way
Portland, OR 97230

LABORATORY PRIMARY STANDARDS

Test	Error
32°F	-.8
212°F	-.6

Certified By: Fluke Model 724 Serial# 9806098
Resubmission Date: 11-18-09

The accuracy stated on this certificate is traceable to the NATIONAL BUREAU OF STANDARDS through certification documents on file in the Metrology Laboratory of the Grant Edgel Company.

Test Conditions

AMBIENT TEMP.: 68°F
REL. HUMIDITY: 45%
DATE: 6-4-09
REPORT NO.: 09F-3
SERVICE ORDER: 20507
P.O. NUMBER:

Authorized Signatures

PERFORMED BY: RG
APPROVED BY: Bob Edgel
RESUBMISSION DATE: 6-4-10

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Grant Edgel Company — MFG. RED COMET OVENS
TELEPHONE 254-6524 (AREA CODE 503)
4233 N. E. 147TH AVENUE · P. O. BOX 20116 · PORTLAND, OREGON 97220

LABORATORY PRIMARY STANDARDS

CERTIFICATE

FOR

Altek Calibrator

Series 22

Serial# 10663701

GRANT EDGEL PRIMARY STANDARDS LABORATORY
ID NO.
DATE
NEXT
BY

Submitted By

Horizon Engineering

13585 NE Whittaker Way

Portland, OR 97230

Test	Error	Test	Error
0°F	+.8	300°F	+.8
50°F	+.7	350°F	+.8
100°F	+.7	400°F	+.9
150°F	+.7	450°F	+.8
250°F	+.9	500°F	+.3

Certified By:
Fluke Model 724
Serial# 9806098
Resubmission Date:
11-18-09

The accuracy stated on this certificate is traceable to the NATIONAL BUREAU OF STANDARDS through certification documents on file in the Metrology Laboratory of the Grant Edgel Company.

Test Conditions

AMBIENT TEMP.: 68°F

REL. HUMIDITY: 45%

DATE: 6-4-09

REPORT NO.: 09F-2

SERVICE ORDER: 20507

P.O. NUMBER:

Authorized Signatures

PERFORMED BY: RG

APPROVED BY: Bob Edgel

RESUBMISSION DATE: 6-4-10

A Satisfied Customer is Our First Consideration

Grant Edgel Company — MFG. RED COMET OVENS

TELEPHONE 254-6524 (AREA CODE 503)

4233 N.E. 147TH AVENUE · P.O. BOX 20116 · PORTLAND, OREGON 97220

LABORATORY PRIMARY STANDARDS

CERTIFICATE

FOR

Altek Calibrator

Series 22

Serial# 10400304

GRANT EDGEL PRIMARY STANDARDS LABORATORY

ID NO.

DATE

NEXT DUE

BY

Submitted By

Horizon Engineering

13585 NE Whittaker Way

Portland, OR 97230

Test	Error	Test	Error
0°F	+.5	300°F	-.5
50°F	-.5	350°F	-.5
100°F	-.6	400°F	-.6
150°F	-.5	450°F	-.6
200°F	-.5	500°F	-1.1

Certified By:
Fluke Model 724
Serial# 9806098
Resubmission Date;
11-18-09

The accuracy stated on this certificate is traceable to the NATIONAL BUREAU OF STANDARDS through certification documents on file in the Metrology Laboratory of the Grant Edgel Company.

Test Conditions

AMBIENT TEMP.: 68°F

REL. HUMIDITY: 45%

DATE: 6-4-09

REPORT NO.: 09F-1

SERVICE ORDER: 20507

P.O. NUMBER:

Authorized Signatures

PERFORMED BY: R.G.

APPROVED BY: Bob Edgel

RESUBMISSION DATE: 6-4-10

A Satisfied Customer is Our First Consideration

Nozzle ID	Measurements			Averages	Date
Quartz					
Q1	0.3160	0.3155	0.3155	**0.3157**	7/10/2009
Q2	0.2625	0.2630	0.2620	**0.2625**	5/1/2009
Q3	0.2515	0.2525	0.2530	**0.2523**	5/1/2009
Q4	0.3200	0.3195	0.3195	**0.3197**	7/10/2009
Q5	0.2750	0.2755	0.2740	**0.2748**	7/14/2009
Q6	0.2608	0.2620	0.2621	**0.2616**	7/10/2009
Q7	0.3110	0.3095	0.3095	**0.3100**	7/10/2009
Q8	0.2574	0.2560	0.2565	**0.2566**	7/10/2009
Q9	0.3630	0.3645	0.3645	**0.3640**	8/5/2009
Q10	0.3695	0.3705	0.3700	**0.3700**	8/5/2009
Q11	0.3735	0.3745	0.3750	**0.3743**	8/5/2009
Q12	0.3700	0.3720	0.3710	**0.3710**	8/5/2009
Q13	0.3690	0.3675	0.3675	**0.3680**	8/5/2009

Nozzle ID	Measurements			Averages	Date
Pyrex					
1	could not locate				
2	could not locate				
3	0.2595	0.2610	0.2605	**0.2603**	7/10/2009
4	0.2605	0.2615	0.2610	**0.2610**	7/10/2009
5	0.2625	0.2630	0.2630	**0.2628**	8/3/2009
6	0.2645	0.2650	0.2640	**0.2645**	8/3/2009
7	0.2640	0.2635	0.2645	**0.2640**	8/3/2009
8	0.2645	0.2650	0.2650	**0.2648**	8/3/2009
9	0.2570	0.2580	0.2580	**0.2576**	8/3/2009
10	0.3135	0.3140	0.3130	**0.3135**	2/12/2009
11	0.3100	0.3105	0.3110	**0.3105**	8/3/2009
12	0.3175	0.3130	0.3135	**0.3147**	5/1/2009
13	0.3175	0.3185	0.3190	**0.3183**	8/3/2009
14	0.3070	0.3085	0.3085	**0.3080**	5/1/2009
15	0.3130	0.3110	0.3120	**0.3120**	5/1/2009
16	0.3115	0.3115	0.3100	**0.3110**	5/1/2009
17	0.4925	0.4940	0.4940	**0.4935**	5/1/2009
18	0.5125	0.5135	0.514	**0.5133**	05/2009

HORIZON ENGINEERING LLC
13585 NE Whitaker Way • Portland, OR 97230
Phone (503) 255-5050 • Fax (503) 255-0505
www.horizonengineering.com

July 3, 2009
Horizon Engineering Shop
Barometer Calibration

National Weather Service (PDX Int'l Airport)	29.90"Hg
TV 1	29.9"Hg
TV 2	29.80"Hg
TV 3	29.9"Hg
Shop	30.1"Hg
Free standing (TV4)	30.0"Hg
Shortridge #1	29.8"Hg
Shortridge #2	29.8"Hg
Shortridge #3	29.9"Hg

All pressures are absolute, read at the Horizon Engineering shop.
Margery P. Heffernan

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12-29-00

SCOTT-MARRIN, INC.

6531 BOX SPRINGS BLVD. • RIVERSIDE, CA 92507
TELEPHONE (951) 653-6780 • FAX (951) 653-2430

Report Of Analysis
EPA Protocol Gas Mixtures

HENG01
TO: Horizon Engineering/Infrared NW
Attn: David Bagwell
13585 NE Whitaker Way
Portland, OR 97230
(503) 255-5050

REPORT NO: 54881-01
REPORT DATE: December 18, 2008
CUSTOMER PO NO: 005335

CYLINDER NUMBER: **CC35012** CYLINDER SIZE: 150A (141 std cu ft) CYLINDER PRESSURE: 2000 psig

COMPONENT	CONCENTRATION (v/v) ± EPA UNCERTAINTY	REFERENCE STANDARD	ANALYZER MAKE, MODEL, S/N, DETECTION	EXPIRATION DATE	REPLICATE ANALYSIS DATA	
Carbon dioxide	5.97 ± 0.06 %	GMIS	Varian Model 3400	12/5/2010	12/5/2008	
		CYLINDER #:	Serial # 10680		5.96 %	
		CC83094	Thermal Conductivity		5.98 %	
		@ 8.09 %	Gas Chromotography		5.98 %	
			LAST CAL DATE: 12/2/2008	MEAN:	5.97 %	
Carbon monoxide	279.3 ± 1.2 ppm	GMIS	Carle Insts Model 8000	12/15/2010	12/8/2008	12/15/2008
		CYLINDER #:	Serial # 8249		279.6 ppm	279.3 ppm
		1L3309	Methanation/FID		279.2 ppm	279.2 ppm
		@ 283.5 ppmv	Gas Chromatography		279.9 ppm	279.2 ppm
			LAST CAL DATE: 11/17/2008	MEAN:	279.6 ppm	279.2 ppm
Nitric oxide	48.7 ± 0.7 ppm	GMIS	Bovar/W Res Model 922M	12/18/2010	12/8/2008	12/18/2008
NOx	48.7 ppm	CYLINDER #:	Serial # VD92284841		48.8 ppm	48.5 ppm
Nitrogen dioxide	< 0.2 ppm	CC108765	Continuous		48.5 ppm	48.8 ppm
		@ 50.1 ppmv	UV Photometry		48.9 ppm	48.9 ppm
			LAST CAL DATE: 11/23/2008	MEAN:	48.7 ppm	48.7 ppm
O2-free Nitrogen	Balance					

ppm = umole/mole % = mole-%

The above analyses were performed in accordance with Procedure G1 of the EPA Traceability Protocol, Report Number EPA-600/R97/121, dated September 1997.

The above analyses are invalid if the cylinder pressure is less than 150 psig.

ANALYST: D. C. M
D.C.Marrin

APPROVED: [signature]
J. T. Marrin

SCOTT-MARRIN, INC.
6531 BOX SPRINGS BLVD. • RIVERSIDE, CA 92507
TELEPHONE (951) 653-6780 • FAX (951) 653-2430

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01-21-09

Report Of Analysis
EPA Protocol Gas Mixtures

HENG01
TO: Horizon Engineering/Infrared NW
Attn: David Bagwell
13585 NE Whitaker Way
Portland, OR 97230
(503) 255-5050

REPORT NO: 55012-02
REPORT DATE: January 14, 2009
CUSTOMER PO NO: 005335

CYLINDER NUMBER: CC1859 CYLINDER SIZE: 150A (141 std cu ft) CYLINDER PRESSURE: 2000 psig

COMPONENT	CONCENTRATION (v/v) ± EPA UNCERTAINTY	REFERENCE STANDARD	ANALYZER MAKE, MODEL, S/N, DETECTION	EXPIRATION DATE	REPLICATE ANALYSIS DATA	
Carbon dioxide	12.52 ± 0.15 %	GMIS	Varian Model 3400	12/26/2010	12/26/2008	
		CYLINDER #:	Serial # 10680		12.53 %	
		CC51172	Thermal Conductivity		12.56 %	
		@ 17.99 %	Gas Chromotography		12.48 %	
			LAST CAL DATE: 12/2/2008	MEAN:	12.52 %	
Carbon monoxide	463 ± 4 ppm	GMIS	Carle Insts Model 8000	12/29/2010	12/21/2008	12/29/2008
		CYLINDER #:	Serial # 8249		462 ppm	464 ppm
		ALM021481	Methanation/FID		462 ppm	462 ppm
		@ 548 ppmv	Gas Chromatography		463 ppm	462 ppm
			LAST CAL DATE: 12/17/2008	MEAN:	462 ppm	463 ppm
Nitric oxide	87.6 ± 0.7 ppm	GMIS	Bovar/W Res Model 922M	1/13/2011	12/31/2008	1/13/2009
NOx	87.6 ppm	CYLINDER #:	Serial # VD92284841		87.2 ppm	87.5 ppm
Nitrogen dioxide	< 0.4 ppm	CC68777	Continuous		87.5 ppm	87.6 ppm
		@ 101.1 ppmv	UV Photometry		87.6 ppm	87.7 ppm
			LAST CAL DATE: 12/31/2008	MEAN:	87.4 ppm	87.6 ppm
O2-free Nitrogen	Balance					

ppm = umole/mole % = mole-%

The above analyses were performed in accordance with Procedure G1 of the EPA Traceability Protocol, Report Number EPA-600/R97/121, dated September 1997.

The above analyses are invalid if the cylinder pressure is less than 150 psig.

ANALYST: D.C. M APPROVED:
D.C.Marrin J. T. Marrin

66

The only liability of this company for gas which fails to comply with this analysis shall be replacement or reanalysis thereof by the company without extra cost.

STANDARD CALIBRATION GASES IN ALUMINUM CYLINDERS

SCOTT-MARRIN, INC.
6531 BOX SPRINGS BLVD. • RIVERSIDE, CA 92507
TELEPHONE (951) 653-6780 • FAX (951) 653-2430

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Report Of Analysis
EPA Protocol Gas Mixtures

HENG01
TO: Horizon Engineering/Infrared NW
Attn: David Bagwell
13585 NE Whitaker Way
Portland, OR 97230
(503) 255-5050

REPORT NO: 54404-01
REPORT DATE: September 11, 2008
CUSTOMER PO NO: 005167

CYLINDER NUMBER: **CC53889** CYLINDER SIZE: 150A (141 std cu ft) CYLINDER PRESSURE: 2000 psig

COMPONENT	CONCENTRATION (v/v) ± EPA UNCERTAINTY	REFERENCE STANDARD	ANALYZER MAKE, MODEL, S/N, DETECTION	EXPIRATION DATE	REPLICATE ANALYSIS DATA	
Carbon dioxide	21.76 ± 0.09 %	GMIS	Varian Model 3400	7/14/2010	7/14/2008	
		CYLINDER #:	Serial # 10680		21.74 %	
		CC51172	Thermal Conductivity		21.76 %	
		@ 17.99 %	Gas Chromotography		21.77 %	
			LAST CAL DATE: 7/8/2008	MEAN:	21.76 %	
Carbon monoxide	850 ± 9 ppm	GMIS	Carle Insts Model 8000	7/18/2010	7/10/2008	7/18/2008
		CYLINDER #:	Serial # 8249		849 ppm	850 ppm
		1L3318	Methanation/FID		851 ppm	849 ppm
		@ 1117 ppmv	Gas Chromatography		851 ppm	852 ppm
			LAST CAL DATE: 7/9/2008	MEAN:	850 ppm	850 ppm
Nitric oxide	181.7 ± 1.2 ppm	GMIS	Bovar/W Res Model 922M	9/11/2010	9/3/2008	9/11/2008
NOx	181.7 ppm	CYLINDER #:	Serial # VD92284841		181.4 ppm	181.7 ppm
Nitrogen dioxide	< 0.9 ppm	CC72078	Continuous		181.8 ppm	181.6 ppm
		@ 254.3 ppmv	UV Photometry		181.7 ppm	181.7 ppm
			LAST CAL DATE: 8/26/2008	MEAN:	181.6 ppm	181.7 ppm
O2-free Nitrogen	Balance					

ppm = umole/mole % = mole-%

The above analyses were performed in accordance with Procedure G1 of the EPA Traceability Protocol, Report Number EPA-600/R97/121, dated September 1997.

The above analyses are invalid if the cylinder pressure is less than 150 psig.

ANALYST: D.C. M[illegible] APPROVED: [illegible]

D.C.Marrin J. T. Marrin

The only liability of this company for gas which fails to comply with this analysis shall be replacement or reanalysis thereof by the company without extra cost.

STANDARD CALIBRATION GASES IN ALUMINUM CYLINDERS

SCOTT-MARRIN, INC.

6531 BOX SPRINGS BLVD. • RIVERSIDE, CA 92507
TELEPHONE (951) 653-6780 • FAX (951) 653-2430

0-5

Report Of Analysis
EPA Protocol Gas Mixtures

HENG01
TO: Horizon Engineering/Infrared NW
Attn: David Bagwell
13585 NE Whitaker Way
Portland, OR 97230
(503) 255-5050

REPORT NO: 54685-01
REPORT DATE: November 10, 2008
11-17-08 CUSTOMER PO NO: 005296

CYLINDER NUMBER: SA5697 CYLINDER SIZE: 150A (141 std cu ft) CYLINDER PRESSURE: 2000 psig

COMPONENT	CONCENTRATION (v/v) ± EPA UNCERTAINTY	REFERENCE STANDARD	ANALYZER MAKE, MODEL, S/N, DETECTION	EXPIRATION DATE	REPLICATE ANALYSIS DATA
Oxygen	11.61 ± 0.06 %	GMIS CYLINDER #: CC51181 @ 10.04 %	Varian Model 3800 Serial # Thermal Conductivity Gas Chromotography LAST CAL DATE: 11/3/2008	11/6/2011	11/6/2008 11.62 % 11.61 % 11.60 % MEAN: 11.61 %
Nitrogen	Balance				

ppm = umole/mole %= mole-%

The above analyses were performed in accordance with Procedure G1 of the EPA Traceability Protocol, Report Number EPA-600/R97/121, dated September 1997.

The above analyses are invalid if the cylinder pressure is less than 150 psig.

ANALYST: M.S.Calhoun APPROVED: J. T. Marrin

QA/QC Documentation

Procedures

Analyzer Interference Response Data

Introduction The QA procedures outlined in the U. S. Environmental Protection Agency (EPA) test methods are followed, including procedures, equipment specifications, calibrations, sample extraction and handling, calculations, and performance tolerances. Many of the checks performed have been cited in the Sampling section of the report text. The results of those checks are on the applicable field data sheets in the Appendix.

Continuous Analyzer Methods Field crews operate the continuous analyzers according to the test method requirements, and Horizon's additional specifications. On site quality control procedures include:

- Analyzer calibration error before initial run and after a failed system bias or drift test (within ± 2.0% of the calibration span of the analyzer for the low, mid, and high-level gases or 0.5 ppmv absolute difference)
- System bias at low-scale (zero) and upscale calibration gases (within ± 5.0% of the calibration span or 0.5 ppmv absolute difference)
- Drift check (within ±3.0% of calibration span for low, and mid or high-level gases, or 0.5 ppmv absolute difference)
- System response time (during initial sampling system bias test)
- Checks performed with EPA Protocol 1 or NIST traceable gases
- Leak free sampling system
- Data acquisition systems record 10-second data points or one-minute averages of one second readings
- NO_2 to NO conversion efficiency (before each test)
- Purge time (= 2 times system response time and will be done before starting run 1, whenever the gas probe is removed and re-inserted into the stack, and after bias checks)
- Sample time (at least two times the system response time at each sample point)
- Sample flow rate (within approximately 10% of the flow rate established during system response time check)
- Interference checks for analyzers used will be included in the final test report
- Average concentration (run average = calibration span for each run)
- Stratification test (to be done during run 1 at three(3) or twelve(12) points according to EPA Method 7E; Method 3A, if done for molecular weight only, will be sampled near the centroid of the exhaust; stratification is check not normally applicable for RATAs)

Manual Equipment QC Procedures On site quality control procedures include pre- and post-test leak checks on trains and pitot systems. If pre-test checks indicate problems, the system is fixed and rechecked before starting testing. If post-test leak checks are not acceptable, the test run is voided and the run is repeated. Thermocouples and readouts are verified in the field to read ambient prior to the start of any heating or cooling devices. Nozzles are checked for nicks or dents and are measured on three diameters twice each year.

Sample Handling Samples taken during testing are handled to prevent contamination from other runs and ambient conditions. Sample containers are glass, Teflon™, or polystyrene (filter petri dishes) and are pre-cleaned by the laboratory and in the Horizon Engineering shop. Sample levels are marked on containers and are verified by the laboratory. All particulate sample containers are kept upright and are delivered to the laboratory by Horizon personnel.

Data Processing Personnel performing data processing double-check that data entry and calculations are correct. Results include corrections for field blanks and analyzer drift. Any abnormal values are verified with testing personnel and the laboratory, if necessary.

After results are obtained, the data processing supervisor validates the data with the following actions:

- verify data entry
- check for variability within replicate runs
- account for variability that is not within performance goals (check the method, testing, and operation of the plant)
- verify field quality checks

Equipment Calibrations Periodic calibrations are performed on each piece of measurement equipment according to manufacturers' specifications and applicable test method requirements. The Oregon Department of Environmental Quality (ODEQ) Source Testing Calibration Requirements sheet is used as a guideline. Calibrations are performed using primary standard references and calibration curves where applicable.

Thermocouples Thermocouples are calibration checked against an NIST traceable thermocouple and indicator system every six months at three points. Thermocouple indicators and temperature controllers are checked using a NIST traceable signal generator. Readouts are checked over their usable range and are adjusted if necessary (which is very unusual).

Pitots Every six months, S-type pitots are calibrated in a wind tunnel at three points against a standard pitot using inclined manometers. They are examined for dents and distortion to the alignment, angles, lengths, and proximity to thermocouples before each test. Pitots are protected with covers during storage and handling until they are ready to be inserted in the sample ports.

Dry Gas Meters Dry gas meters used in the manual sampling trains are calibrated at three rates using a standard dry gas meter that is never taken into the field. The standard meter is calibration verified by the Northwest Natural Gas meter shop once every year. Dry gas meters are post-test calibrated with documentation provided in test reports.

HORIZON ENGINEERING LLC

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Phone (503) 255-5050 • Fax (503) 255-0505
www.horizonengineering.com

INTERFERENCE RESPONSE TEST

Date of Test: 3/13/02 Name: Tim Hertel
Analyzer: Type / Model: O_2 / Servomex Serial Number: 000038

Test Gas	Concentration, ppmv or %	Analyzer Output Response, %	% of Span (25 %)
SO_2	170.3 ppmv	0.0	0.0
*CO_2	9.1%	0.0	0.0
**CO	540 ppmv	0.0	0.0

*Used bottle of CO_2 at 100% concentration and diluted it with 100% N2 to get a concentration of about 10% CO_2.

** Used CO cylinder with 5% concentration and diluted it with 100% N_2 to get a concentration of about 500 ppmv CO.

Bias Check:

Test Gas	Concentration, %	Analyzer Output Response, %	Bias Check (%)
O_2	20.95	20.9	0.2

Performance Specifications:

Analyzer	EPA Ref. Method	Allowable Interference (% of analyzer span)	Gas Values To Introduce Into Analyzers (EPA Method 20)
SO_2	6C	7%	200±20 ppm
O_2	6C	7%	20.9±1 percent
CO_2	6C	7%	10±1 percent
CO	20	2%	500±50 ppm

Note: Concentration for SO_2 was slightly lower than listed; 170.3 ppmv was the closest concentration cylinder available at the time of the interference checks.

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INTERFERENCE RESPONSE TEST

Date of Test: 3/01 & 3/07/2002 Name: Tim Hertel
Analyzer: Type / Model: CO_2 / Servomex 1400 Serial Number: 000166

Results:

Test Gas	Concentration, ppmv or %	Analyzer Output Response, %	% of Span (25 %)
SO_2	170.3 ppmv	0.0	0.0
O_2	20.95%	0.0	0.0
*CO	534 ppmv	0.0	0.0

* Used CO cylinder with 5% concentration and diluted it with 100% N_2 to get a concentration of about 500 ppmv CO.

Bias Check:

Test Gas	Concentration, %	Analyzer Output Response, %	Bias Check (%)
**CO_2	10.3	10.3	0.0

** Used bottle of CO_2 at 100% concentration and diluted it with 100% N_2 to get a concentration of about 10% CO_2.

Performance Specifications:

Analyzer	EPA Ref. Method	Allowable Interference (% of analyzer span)	Gas Values To Introduce Into Analyzers (EPA Method 20)
SO_2	6C	7%	200±20 ppm
O_2	6C	7%	20.9±1 percent
CO_2	6C	7%	10±1 percent
CO	20	2%	500±50 ppm

Note: Concentration for SO_2 was slightly lower than listed; 170.3 ppmv was the closest concentration cylinder available at the time of the interference checks.

Correspondence

Source Test Plan and Correspondence

Permit (Selected Pages)

e-mailed
6/24/09

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June 24, 2009 Project No. 3302

Ms. Madonna Narvaez
Environmental Engineer
USEPA Region 10, AWT-107
1200 Sixth Avenue
Seattle, WA 98101

Mr. Gerry Pade
Puget Sound Clean Air Agency
1904 3rd Ave, Suite 105
Seattle, WA 98101-3317

Re: Source Testing: Saint-Gobain Containers
5801 East Marginal Way S.
Seattle, Washington 98134

This correspondence is notice that Horizon Engineering is to do source testing for the above-referenced facility, scheduled for August 4, 2009. This will serve as the Source Test Plan unless changes are requested prior to the start of testing.

1. **Source to be Tested:** Glass Melting Furnace No. 4

2. **Purpose of the Testing:** To demonstrate compliance with the National Emission Standard for Hazardous Air Pollutants for Glass Manufacturing Area Sources, 40 CFR Part 63, Subpart SSSSSS for affected sources.

3. **Source Description:** Furnace No. 4 is an end-port regenerative furnace and is air-fuel fired, also utilizing natural gas as its primary fuel source. As a regenerative furnace, its increased fuel efficiency is realized by utilizing the heat generated in the combustion process to preheat the air and fuel used in further combustion processes. Additionally, increased thermal efficiency is realized by the regenerative furnace in providing heat to the primary glass-melting process itself.

4. **Pollutant to be Tested:** Chrome

5. **Test Methods to be Used:** Testing will be conducted in accordance with EPA Methods in Title 40 Code of Federal Regulations Part 60 (40 CFR 60), Appendix A, July 1, 2007.

Flow Rate:	EPA Methods 1 and 2 (pitot traverses with EPA Method 29)
CO_2 and O_2:	EPA Method 3/3A (integrated bag samples w/analyzers)
Moisture:	EPA Method 4 (incorporated with EPA Method 29)
Chrome:	EPA Method 29 (isokinetic impinger technique with analysis by ICP-OES/ICP-MS)

6. **Continuous Analyzer Gas Sampling:** EPA Method 3/3A will be sampled at one point near the exhaust centroid if it is not done for a correction. Particulate and gas sampling will be simultaneous.

7. **Quality Assurance /Quality Control (QA/QC):** Documentation of the procedures and results will be presented in the source test report for review. This documentation will include at least the following:

   Continuous analyzer QC procedures for Tedlar bags: Field crews will operate the analyzers according to the test method requirements and Horizon's additional specifications. On-site quality control procedures include:

   - Daily calibration (zero and span) and calibration error (linearity) checks
   - Tedlar bags will be analyzed after daily calibration and calibration error checks
   - Checks performed with EPA Protocol 1gases
   - Data acquisition systems record one-minute averages of one second readings

   Manual equipment QC procedures: Operators will perform pre- and post-test leak checks on the sampling system and pitot lines. Thermocouple systems are checked for ambient temperature before heaters are started. Nozzles are inspected for nicks or dents and pitots are checked for alignment before each test. Pre- and post-test calibrations on the meter boxes will be included with the report, along with semi-annual calibrations on the pitots, thermocouples, and nozzles. Blank reagents are submitted to the laboratory with the samples. Liquid levels are marked on sample jars in the field and are verified by the laboratory.

8. **Number of Sampling Replicates and their Duration:** Three (3) test runs of approximately 120 minutes each will be performed on the Glass Melting Furnace No. 4.

9. **Reporting Units for Results:** Test results will be expressed as concentrations (gr/dscf), as rates (lb/hr), and on a production basis (lb/ton of glass melted).

10. **Horizon Engrg. Contacts:** David Bagwell or
    Jason Bouwman
    (503) 255-5050
    Fax (503) 255-0505
    E-mail dbagwell@horizonengineering.com

jbouwman@horizonengineering.com

11. **Parent Company Contact:** Jayne Browning
(765) 741-7112
Fax (765) 741-4846
E-mail jayne.e.browning@saint-gobain.com

12. **Source Site Personnel:** Marlon Trigg
(206) 768-6221
Mobile (206) 730-1888
Fax (206) 768-6266
E-mail Marlon.Trigg@saint-gobain.com

13. **Regulatory Contacts:** Gerry Pade or
Tom Hudson
(206) 689-4065
(206) 689-4026
Fax (206) 343-7522
E-mail gerryp@pscleanair.org
tomh@pscleanair.org

Madonna Narvaez
(206) 553-2117
Fax (206) 553-0110
E-mail narvaez.madonna@epa.gov

14. **Applicable Process/Production Information:** Process operating data and production information that characterizes the source operation is considered to be:

- Fuel usage during each run
- Amount of glass melted
- All other normally recorded process information

Process information is to be gathered by the Source Site Personnel and provided to Horizon for inclusion in the report.

The source must operate at a normal rate during testing.

15. **Control Device Operating Parameters:** N.A.

16. **Other Considerations:**

- It is requested that the sixty day test plan notification be waived because of the variability of the production schedule and the short time in which the green glass will be produced.
- Each furnace exhaust has been checked for cyclonic flow during past testing and no cyclonic conditions exist at any exhaust. Cyclonic flow checks were done on September 22, 2005 and February 25, 2009 and are documented in those test reports.

17. **Administrative:** Unless notified prior to the start of testing, this test plan is considered to be approved for compliance testing of this source. A letter

acknowledging receipt of this plan and agreement on the content (or changes as necessary) would be appreciated.

The Agency will be notified of any changes in source test plans prior to testing. It is recognized that significant changes not acknowledged, which could affect accuracy and reliability of the results, could result in test report rejection.

Source test reports will be prepared by Horizon Engineering and will include all results and example calculations, field sampling and data reduction procedures, laboratory analysis reports, and QA/QC documentation. Source test reports will be submitted to you within 60 days of the completion of the field work, unless another deadline is agreed upon. Saint-Gobain Containers should send one (1) copy of the completed source test report to you at the address above.

Any questions or comments relating to this test plan should be directed to me.

Sincerely,

David Bagwell, QSTI
Managing Member
Horizon Engineering

cc: Jayne Browning, Saint-Gobain Containers, Inc.
Marlon Trigg, Saint-Gobain Containers, Inc.
Valerie Krulic, Saint-Gobain Containers, Inc.

pscleanair.org
Puget Sound Clean Air Agency

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<www.pscleanair.org>

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COMPLIANCE TEST NOTIFICATION

This Notification of intended action does not constitute approval by the Agency nor does it satisfy a requirement for a test plan, if one exists.

Agency Use Only: Reg No: ***Date Received:*** ***Date Logged:***

Facility Name: Saint-Gobain Containers

Facility Address (include city/state/zip):
5801 East Marginal Way South
Seattle, Washington 98134

Facility Contact Information for Test
Name: Marlon Trigg
Phone: 206-730-1888
Fax: 206-768-6266
E-Mail: Marlon.Trigg@saint-gobain.com

Test Contractor: Horizon Engineering

Test Contractor Mailing Address:
13585 NE Whitaker Way
Portland, Oregon 97230

Test Contractor Contact Information
Name: David Bagwell
Phone: 503-255-5050
Fax: 503-255-0505
E-Mail: dbagwell@horizonengineering.com

Testing Dates: August 4, 2009

Emission Unit	Pollutant Tested	Test Method(s) (list all to be used)	Purpose for the Test (see Note below)
Glass Melting Furnace No. 4	Chrome	EPA Methods 1, 2, 3/3A, 4, & 29	To demonstrate compliance with the National Emission Standard for Hazardous Air Pollutants for Glass Manufacturing Area Sources, 40 CFR Part 63, Subpart SSSSSS for affected sources

Any Test Method Deviations?
Yes *(attach explanation)* ☑ No
Method Deviations: Furnace No. 3 only has one port

Written Test Plan Required?
☑ Yes No Unknown

Attachments to this Notification? ☑ Yes *(list below)* No
Source Test Plan

Person Submitting Notification:
David Bagwell

Affiliation:
Horizon Engineering

NOTE: For example, NSPS/NESHAP Subpart, citation, NOC Order of Approval #, PSD, Puget Sound Clean Air Agency Regulations (I, II, or III), RATA, or Other. Please include the specific requirement if you have it.

■ 4. Part 63 is amended by adding subpart SSSSSS to read as follows:

Subpart SSSSSS—National Emission Standards for Hazardous Air Pollutants for Glass Manufacturing Area Sources

Applicability and Compliance Dates

§ 63.11448 Am I subject to this subpart?

You are subject to this subpart if you own or operate a glass manufacturing facility that is an area source of hazardous air pollutant (HAP) emissions and meets all of the criteria specified in paragraphs (a) through (c) of this section.

(a) A glass manufacturing facility is a plant site that manufactures flat glass, glass containers, or pressed and blown glass by melting a mixture of raw materials, as defined in § 63.11459, to produce molten glass and form the molten glass into sheets, containers, or other shapes.

(b) An area source of HAP emissions is any stationary source or group of stationary sources within a contiguous area under common control that does not have the potential to emit any single HAP at a rate of 9.07 megagrams per year (Mg/yr) (10 tons per year (tpy)) or more and any combination of HAP at a rate of 22.68 Mg/yr (25 tpy) or more.

(c) Your glass manufacturing facility uses one or more continuous furnaces to produce glass that contains compounds of one or more glass manufacturing metal HAP, as defined in § 63.11459, as raw materials in a glass manufacturing batch formulation.

§ 63.11449 What parts of my plant does this subpart cover?

(a) This subpart applies to each existing or new affected glass melting furnace that is located at a glass manufacturing facility and satisfies the requirements specified in paragraphs (a)(1) through (3) of this section.

(1) The furnace is a continuous furnace, as defined in § 63.11459.

(2) The furnace is charged with compounds of one or more glass manufacturing metal HAP as raw materials.

(3) The furnace is used to produce glass, which contains one or more of the glass manufacturing metal HAP as raw materials, at a rate of at least 45 Mg/yr (50 tpy).

(b) A furnace that is a research and development process unit, as defined in § 63.11459, is not an affected furnace under this subpart.

(c) An affected source is an existing source if you commenced construction or reconstruction of the affected source on or before September 20, 2007.

(d) An affected source is a new source if you commenced construction or reconstruction of the affected source after September 20, 2007.

(e) If you own or operate an area source subject to this subpart, you must obtain a permit under 40 CFR part 70 or 40 CFR part 71.

§ 63.11450 What are my compliance dates?

(a) If you have an existing affected source, you must comply with the applicable emission limits specified in § 63.11451 of this subpart no later than December 28, 2009. As specified in section 112(i)(3)(B) of the Clean Air Act and in § 63.6(i)(4)(A), you may request that the Administrator or delegated authority grant an extension allowing up to 1 additional year to comply with the applicable emission limits if such additional period is necessary for the installation of emission controls.

(b) If you have a new affected source, you must comply with this subpart according to paragraphs (b)(1) and (2) of this section.

(1) If you start up your affected source on or before December 26, 2007, you must comply with the applicable emission limit specified in § 63.11451 no later than December 26, 2007.

(2) If you start up your affected source after December 26, 2007, you must comply with the applicable emission limit specified in § 63.11451 upon initial startup of your affected source.

(c) If you own or operate a furnace that produces glass containing one or more glass manufacturing metal HAP as raw materials at an annual rate of less than 45 Mg/yr (50 tpy), and you increase glass production for that furnace to an annual rate of at least 45 Mg/yr (50 tpy), you must comply with the applicable emission limit specified in § 63.11451 within 2 years of the date on which you increased the glass production rate for the furnace to at least 45 Mg/yr (50 tpy).

(d) If you own or operate a furnace that produces glass at an annual rate of at least 45 Mg/yr (50 tpy) and is not charged with glass manufacturing metal HAP, and you begin production of a glass product that includes one or more glass manufacturing metal HAP as raw materials, and you produce at least 45 Mg/yr (50 tpy) of this glass product, you must comply with the applicable emission limit specified in § 63.11451 within 2 years of the date on which you introduced production of the glass product that contains glass manufacturing metal HAP.

(e) You must meet the notification requirements in § 63.11456 according to the schedule in § 63.11456 and in 40 CFR part 63, subpart A. Some of the notifications must be submitted before you are required to comply with emission limits specified in this subpart.

Standards, Compliance, and Monitoring Requirements

§ 63.11451 What are the standards for new and existing sources?

If you are an owner or operator of an affected furnace, as defined in § 63.11449(a), you must meet the applicable emission limit specified in Table 1 to this subpart.

§ 63.11452 What are the performance test requirements for new and existing sources?

(a) If you own or operate an affected furnace that is subject to an emission limit specified in Table 1 to this subpart, you must conduct a performance test according to paragraphs (a)(1) through (3) and paragraph (b) of this section.

(1) For each affected furnace, you must conduct a performance test within 180 days after your compliance date and report the results in your Notification of Compliance Status, except as specified in paragraph (a)(2) of this section.

(2) You are not required to conduct a performance test on the affected furnace if you satisfy the conditions described in paragraphs (a)(2)(i) through (iii) of this section.

(i) You conducted a performance test on the affected furnace within the past 5 years of the compliance date using the same test methods and procedures specified in paragraph (b) of this section.

(ii) The performance test demonstrated that the affected furnace met the applicable emission limit specified in Table 1 to this subpart.

(iii) Either no process changes have been made since the test, or you can demonstrate that the results of the performance test, with or without adjustments, reliably demonstrate compliance with the applicable emission limit.

(3) If you operate multiple identical furnaces, as defined in § 63.11459, that are affected furnaces, you are required to test only one of the identical furnaces if you meet the conditions specified in paragraphs (a)(3)(i) through (iii) of this section.

(i) You must conduct the performance test while the furnace is producing glass that has the greatest potential to emit the glass manufacturing metal HAP from among the glass formulations that are used in any of the identical furnaces.

(ii) You certify in your Notification of Compliance Status that the identical furnaces meet the definition of identical furnaces specified in § 63.11459.

(iii) You provide in your Notification of Compliance Status documentation that demonstrates why the tested glass formulation has the greatest potential to emit the glass manufacturing metal HAP.

(b) You must conduct each performance test according to the requirements in § 63.7 and paragraphs (b)(1) through (12) and either paragraph (b)(13) or (b)(14) of this section.

(1) Install and validate all monitoring equipment required by this subpart before conducting the performance test.

(2) You may not conduct performance tests during periods of startup, shutdown, or malfunction, as specified in § 63.7(e)(1).

(3) Conduct the test while the source is operating at the maximum production rate.

(4) Conduct at least three separate test runs with a minimum duration of 1 hour for each test run, as specified in § 63.7(e)(3).

(5) Record the test date.

(6) Identify the emission source tested.

(7) Collect and record the emission test data listed in this section for each run of the performance test.

(8) Locate all sampling sites at the outlet of the furnace control device or at the furnace stack prior to any releases to the atmosphere.

(9) Select the locations of sampling ports and the number of traverse points using Method 1 or 1A of 40 CFR part 60, appendix A–1.

(10) Measure the gas velocity and volumetric flow rate using Method 2, 2A, 2C, 2F, or 2G of 40 CFR part 60, appendices A–1 and A–2, during each test run.

(11) Conduct gas molecular weight analysis using Methods 3, 3A, or 3B of 40 CFR part 60, appendix A–2, during each test run. You may use ANSI/ASME PTC 19.10–1981, Flue and Exhaust Gas Analyses (incorporated by reference—see § 63.14) as an alternative to EPA Method 3B.

(12) Measure gas moisture content using Method 4 of 40 CFR part 60, appendix A–3, during each test run.

(13) To meet the particulate matter (PM) emission limit specified in Table 1 to this subpart, you must conduct the procedures specified in paragraphs (b)(13)(i) through (v) of this section.

(i) Measure the PM mass emission rate at the outlet of the control device or at the stack using Method 5 or 17 of 40 CFR part 60, appendices A–3 or A–6, for each test run.

(ii) Calculate the PM mass emission rate in the exhaust stream for each test run.

(iii) Measure and record the glass production rate (kilograms (tons) per hour of product) for each test run.

(iv) Calculate the production-based PM mass emission rate (g/kg (lb/ton)) for each test run using Equation 1 of this section.

$$MP = \frac{ER}{P} \qquad \text{(Equation 1)}$$

Where:

MP = Production-based PM mass emission rate, grams of PM per kilogram (pounds of PM per ton) of glass produced.

ER = PM mass emission rate measured using Methods 5 or 17 during each performance test run, grams (pounds) per hour.

P = Average glass production rate for the performance test, kilograms (tons) of glass produced per hour.

(v) Calculate the 3-hour block average production-based PM mass emission rate as the average of the production-based PM mass emission rates for each test run.

(14) To meet the metal HAP emission limit specified in Table 1 to this subpart, you must conduct the procedures specified in paragraphs (b)(14)(i) through (v) of this section.

(i) Measure the metal HAP mass emission rate at the outlet of the control device or at the stack using Method 29 of 40 CFR part 60, appendix A–8, for each test run.

(ii) Calculate the metal HAP mass emission rate in the exhaust stream for the glass manufacturing metal HAP that are added as raw materials to the glass manufacturing formulation for each test run.

(iii) Measure and record the glass production rate (kilograms (tons) per hour of product) for each test run.

(iv) Calculate the production-based metal HAP mass emission rate (g/kg (lb/ton)) for each test run using Equation 2 of this section.

$$MPM = \frac{ERM}{P} \qquad \text{(Equation 2)}$$

Where:

MPM = Production-based metal HAP mass emission rate, grams of metal HAP per kilogram (pounds of metal HAP per ton) of glass produced.

ERM = Sum of the metal HAP mass emission rates for the glass manufacturing metal HAP that are added as raw materials to the glass manufacturing formulation and are measured using Method 29 during each performance test run, grams (pounds) per hour.

P = Average glass production rate for the performance test, kilograms (tons) of glass produced per hour.

(v) Calculate the 3-hour block average production-based metal HAP mass emission rate as the average of the production-based metal HAP mass emission rates for each test run.

§ 63.11453 What are the initial compliance demonstration requirements for new and existing sources?

(a) If you own or operate an affected source, you must submit a Notification of Compliance Status in accordance with §§ 63.9(h) and 63.11456(b).

(b) For each existing affected furnace that is subject to the emission limits specified in Table 1 to this subpart, you must demonstrate initial compliance according to the requirements in paragraphs (b)(1) through (4) of this section.

(1) For each fabric filter that is used to meet the emission limit specified in Table 1 to this subpart, you must visually inspect the system ductwork and fabric filter unit for leaks. You must also inspect the inside of each fabric filter for structural integrity and fabric filter condition. You must record the results of the inspection and any maintenance action as required in § 63.11457(a)(6).

(2) For each electrostatic precipitator (ESP) that is used to meet the emission limit specified in Table 1 to this subpart, you must verify the proper functioning of the electronic controls for corona power and rapper operation, that the corona wires are energized, and that adequate air pressure is present on the rapper manifold. You must also visually inspect the system ductwork and ESP housing unit and hopper for leaks and inspect the interior of the ESP to determine the condition and integrity of corona wires, collection plates, hopper, and air diffuser plates. You must record the results of the inspection and any maintenance action as required in § 63.11457(a)(6).

(3) You must conduct each inspection specified in paragraphs (b)(1) and (2) of this section no later than 60 days after your applicable compliance date specified in § 63.11450, except as specified in paragraphs (b)(3)(i) and (ii) of this section.

(i) An initial inspection of the internal components of a fabric filter is not required if an inspection has been performed within the past 12 months.

(ii) An initial inspection of the internal components of an ESP is not required if an inspection has been performed within the past 24 months.

(4) You must satisfy the applicable requirements for performance tests specified in § 63.11452.

(c) For each new affected furnace that is subject to the emission limit specified in Table 1 to this subpart and is controlled with a fabric filter, you must install, operate, and maintain a bag leak detection system according to paragraphs (c)(1) through (3) of this section.

(1) Each bag leak detection system must meet the specifications and requirements in paragraphs (c)(1)(i) through (viii) of this section.

(i) The bag leak detection system must be certified by the manufacturer to be capable of detecting PM emissions at concentrations of 1 milligram per dry standard cubic meter (0.00044 grains per actual cubic foot) or less.

(ii) The bag leak detection system sensor must provide output of relative PM loadings. The owner or operator shall continuously record the output from the bag leak detection system using electronic or other means (e.g., using a strip chart recorder or a data logger).

(iii) The bag leak detection system must be equipped with an alarm system that will sound when the system detects an increase in relative particulate loading over the alarm set point established according to paragraph (c)(1)(iv) of this section, and the alarm must be located such that it can be heard by the appropriate plant personnel.

(iv) In the initial adjustment of the bag leak detection system, you must establish, at a minimum, the baseline output by adjusting the sensitivity (range) and the averaging period of the device, the alarm set points, and the alarm delay time.

(v) Following initial adjustment, you shall not adjust the averaging period, alarm set point, or alarm delay time without approval from the Administrator or delegated authority except as provided in paragraph (c)(1)(vi) of this section.

(vi) Once per quarter, you may adjust the sensitivity of the bag leak detection system to account for seasonal effects, including temperature and humidity, according to the procedures identified in the site-specific monitoring plan required by paragraph (c)(2) of this section.

(vii) You must install the bag leak detection sensor downstream of the fabric filter.

(viii) Where multiple detectors are required, the system's instrumentation and alarm may be shared among detectors.

(2) You must develop and submit to the Administrator or delegated authority for approval a site-specific monitoring plan for each bag leak detection system. You must operate and maintain the bag leak detection system according to the site-specific monitoring plan at all times. Each monitoring plan must describe the items in paragraphs (c)(2)(i) through (vi) of this section.

(i) Installation of the bag leak detection system;

(ii) Initial and periodic adjustment of the bag leak detection system, including how the alarm set-point will be established;

(iii) Operation of the bag leak detection system, including quality assurance procedures;

(iv) How the bag leak detection system will be maintained, including a routine maintenance schedule and spare parts inventory list;

(v) How the bag leak detection system output will be recorded and stored; and

(vi) Corrective action procedures as specified in paragraph (c)(3) of this section. In approving the site-specific monitoring plan, the Administrator or delegated authority may allow owners and operators more than 3 hours to alleviate a specific condition that causes an alarm if the owner or operator identifies in the monitoring plan this specific condition as one that could lead to an alarm, adequately explains why it is not feasible to alleviate this condition within 3 hours of the time the alarm occurs, and demonstrates that the requested time will ensure alleviation of this condition as expeditiously as practicable.

(3) For each bag leak detection system, you must initiate procedures to determine the cause of every alarm within 1 hour of the alarm. Except as provided in paragraph (c)(2)(vi) of this section, you must alleviate the cause of the alarm within 3 hours of the alarm by taking whatever corrective action(s) are necessary. Corrective actions may include, but are not limited to the following:

(i) Inspecting the fabric filter for air leaks, torn or broken bags or filter media, or any other condition that may cause an increase in PM emissions;

(ii) Sealing off defective bags or filter media;

(iii) Replacing defective bags or filter media or otherwise repairing the control device;

(iv) Sealing off a defective fabric filter compartment;

(v) Cleaning the bag leak detection system probe or otherwise repairing the bag leak detection system; or

(vi) Shutting down the process producing the PM emissions.

(d) For each new affected furnace that is subject to the emission limit specified in Table 1 to this subpart and is controlled with an ESP, you must install, operate, and maintain according to the manufacturer's specifications, one or more continuous parameter monitoring systems (CPMS) for measuring and recording the secondary voltage and secondary electrical current to each field of the ESP according to paragraphs (d)(1) through (13) of this section.

(1) The CPMS must have an accuracy of 1 percent of the secondary voltage and secondary electrical current, or better.

(2) Your CPMS must be capable of measuring the secondary voltage and secondary electrical current over a range that extends from a value that is at least 20 percent less than the lowest value that you expect your CPMS to measure, to a value that is at least 20 percent greater than the highest value that you expect your CPMS to measure.

(3) The signal conditioner, wiring, power supply, and data acquisition and recording system of your CPMS must be compatible with the output signal of the sensors used in your CPMS.

(4) The data acquisition and recording system of your CPMS must be able to record values over the entire range specified in paragraph (d)(2) of this section.

(5) The data recording system associated with your CPMS must have

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a resolution of one-half of the required overall accuracy of your CPMS, as specified in paragraph (d)(1) of this section, or better.

(6) Your CPMS must be equipped with an alarm system that will sound when the system detects a decrease in secondary voltage or secondary electrical current below the alarm set point established according to paragraph (d)(7) of this section, and the alarm must be located such that it can be heard by the appropriate plant personnel.

(7) In the initial adjustment of the CPMS, you must establish, at a minimum, the baseline output by adjusting the sensitivity (range) and the averaging period of the device, the alarm set points, and the alarm delay time.

(8) You must install each sensor of the CPMS in a location that provides representative measurement of the appropriate parameter over all operating conditions, taking into account the manufacturer's guidelines.

(9) You must perform an initial calibration of your CPMS based on the procedures specified in the manufacturer's owner's manual.

(10) Your CPMS must be designed to complete a minimum of one cycle of operation for each successive 15-minute period. To have a valid hour of data, you must have at least three of four equally-spaced data values (or at least 75 percent of the total number of values if you collect more than four data values per hour) for that hour (not including startup, shutdown, malfunction, or out of control periods).

(11) You must record valid data from at least 90 percent of the hours during which the affected source or process operates.

(12) You must record the results of each inspection, calibration, initial validation, and accuracy audit.

(13) At all times, you must maintain your CPMS including, but not limited to, maintaining necessary parts for routine repairs of the CPMS.

(e) For each new affected furnace that is subject to the emission limit specified in Table 1 to this subpart and is controlled by a device other than a fabric filter or an ESP, you must prepare and submit a monitoring plan to EPA or the delegated authority for approval. Each plan must contain the information in paragraphs (e)(1) through (5) of this section.

(1) A description of the device;

(2) Test results collected in accordance with § 63.11452 verifying the performance of the device for reducing PM or metal HAP to the levels required by this subpart;

(3) Operation and maintenance plan for the control device (including a preventative maintenance schedule consistent with the manufacturer's instructions for routine and long-term maintenance) and continuous monitoring system;

(4) A list of operating parameters that will be monitored to maintain continuous compliance with the applicable emission limits; and

(5) Operating parameter limits based on monitoring data collected during the performance test.

§ 63.11454 What are the monitoring requirements for new and existing sources?

(a) For each monitoring system required by this subpart, you must install, calibrate, operate, and maintain the monitoring system according to the manufacturer's specifications and the requirements specified in paragraphs (a)(1) through (7) of this section.

(1) You must install each sensor of your monitoring system in a location that provides representative measurement of the appropriate parameter over all operating conditions, taking into account the manufacturer's guidelines.

(2) You must perform an initial calibration of your monitoring system based on the manufacturer's recommendations.

(3) You must use a monitoring system that is designed to complete a minimum of one cycle of operation for each successive 15-minute period.

(4) For each existing affected furnace, you must record the value of the monitored parameter at least every 8 hours. The value can be recorded electronically or manually.

(5) You must record the results of each inspection, calibration, monitoring system maintenance, and corrective action taken to return the monitoring system to normal operation.

(6) At all times, you must maintain your monitoring system including, but not limited to, maintaining necessary parts for routine repairs of the system.

(7) You must perform the required monitoring whenever the affected furnace meets the conditions specified in paragraph (a)(7)(i) or (ii) of this section.

(i) The furnace is being charged with one or more of the glass manufacturing metal HAP as raw materials.

(ii) The furnace is in transition between producing glass that contains one or more of the glass metal HAP as raw materials and glass that does not contain any of the glass manufacturing metal HAP as raw materials. The transition period begins when the furnace is charged with raw materials that do not contain any of the glass manufacturing metal HAP as raw materials and ends when the furnace begins producing a saleable glass product that does not contain any of the glass manufacturing metal HAP as raw materials.

(b) For each existing furnace that is subject to the emission limit specified in Table 1 to this subpart and is controlled with an ESP, you must meet the requirements specified in paragraphs (b)(1) or (2) of this section.

(1) You must monitor the secondary voltage and secondary electrical current to each field of the ESP according to the requirements of paragraph (a) of this section, or

(2) You must submit a request for alternative monitoring, as described in paragraph (g) of this section.

(c) For each existing furnace that is subject to the emission limit specified in Table 1 to this subpart and is controlled with a fabric filter, you must meet the requirements specified in paragraphs (c)(1) or (2) of this section.

(1) You must monitor the inlet temperature to the fabric filter according to the requirements of paragraph (a) of this section, or

(2) You must submit a request for alternative monitoring, as described in paragraph (g) of this section.

(d) For each new furnace that is subject to the emission limit specified in Table 1 to this subpart and is controlled with an ESP, you must monitor the voltage and electrical current to each field of the ESP on a continuous basis using one or more CPMS according to the requirements for CPMS specified in § 63.11453(d).

(e) For each new furnace that is subject to the emission limit specified in Table 1 to this subpart and is controlled with a fabric filter, you must install and operate a bag leak detection system according to the requirements specified in § 63.11453(c).

(f) For each new or existing furnace that is subject to the emission limit specified in Table 1 to this subpart and is equipped with a control device other than an ESP or fabric filter, you must meet the requirements in § 63.8(f) and submit a request for approval of alternative monitoring methods to the Administrator no later than the submittal date for the Notification of Compliance Status, as specified in § 63.11456(b). The request must contain the information specified in paragraphs (f)(1) through (5) of this section.

(1) Description of the alternative add-on air pollution control device (APCD).

(2) Type of monitoring device or method that will be used, including the sensor type, location, inspection

procedures, quality assurance and quality control (QA/QC) measures, and data recording device.

(3) Operating parameters that will be monitored.

(4) Frequency that the operating parameter values will be measured and recorded.

(5) Procedures for inspecting the condition and operation of the control device and monitoring system.

(g) If you wish to use a monitoring method other than those specified in paragraph (b)(1) or (c)(1) of this section, you must meet the requirements in § 63.8(f) and submit a request for approval of alternative monitoring methods to the Administrator no later than the submittal date for the Notification of Compliance Status, as specified in § 63.11456(b). The request must contain the information specified in paragraphs (g)(1) through (5) of this section.

(1) Type of monitoring device or method that will be used, including the sensor type, location, inspection procedures, QA/QC measures, and data recording device.

(2) Operating parameters that will be monitored.

(3) Frequency that the operating parameter values will be measured and recorded.

(4) Procedures for inspecting the condition and operation of the monitoring system.

(5) Explanation for how the alternative monitoring method will provide assurance that the emission control device is operating properly.

§ 63.11455 What are the continuous compliance requirements for new and existing sources?

(a) You must be in compliance with the applicable emission limits in this subpart at all times, except during periods of startup, shutdown, and malfunction.

(b) You must always operate and maintain your affected source, including air pollution control and monitoring equipment, according to the provisions in § 63.6(e)(1)(i).

(c) For each affected furnace that is subject to the emission limit specified in Table 1 to this subpart, you must monitor the performance of the furnace emission control device under the conditions specified in § 63.11454(a)(7) and according to the requirements in §§ 63.6(e)(1) and 63.8(c) and paragraphs (c)(1) through (6) of this section.

(1) For each existing affected furnace that is controlled with an ESP, you must monitor the parameters specified in § 63.11454(b) in accordance with the requirements of § 63.11454(a) or as specified in your approved alternative monitoring plan.

(2) For each new affected furnace that is controlled with an ESP, you must comply with the monitoring requirements specified in § 63.11454(d) in accordance with the requirements of § 63.11454(a) or as specified in your approved alternative monitoring plan.

(3) For each existing affected furnace that is controlled with a fabric filter, you must monitor the parameter specified in § 63.11454(c) in accordance with the requirements of § 63.11454(a) or as specified in your approved alternative monitoring plan.

(4) For each new affected furnace that is controlled with a fabric filter, you must comply with the monitoring requirements specified in § 63.11454(e) in accordance with the requirements of § 63.11454(a) or as specified in your approved alternative monitoring plan.

(5) For each affected furnace that is controlled with a device other than a fabric filter or ESP, you must comply with the requirements of your approved alternative monitoring plan, as required in § 63.11454(g).

(6) For each monitoring system that is required under this subpart, you must keep the records specified in § 63.11457.

(d) Following the initial inspections, you must perform periodic inspections and maintenance of each affected furnace control device according to the requirements in paragraphs (d)(1) through (4) of this section.

(1) For each fabric filter, you must conduct inspections at least every 12 months according to paragraphs (d)(1)(i) through (iii) of this section.

(i) You must inspect the ductwork and fabric filter unit for leakage.

(ii) You must inspect the interior of the fabric filter for structural integrity and to determine the condition of the fabric filter.

(iii) If an initial inspection is not required, as specified in § 63.11453(b)(3)(i), the first inspection must not be more than 12 months from the last inspection.

(2) For each ESP, you must conduct inspections according to the requirements in paragraphs (d)(2)(i) through (iii) of this section.

(i) You must conduct visual inspections of the system ductwork, housing unit, and hopper for leaks at least every 12 months.

(ii) You must conduct inspections of the interior of the ESP to determine the condition and integrity of corona wires, collection plates, plate rappers, hopper, and air diffuser plates every 24 months.

(iii) If an initial inspection is not required, as specified in § 63.11453(b)(3)(ii), the first inspection must not be more than 24 months from the last inspection.

(3) You must record the results of each periodic inspection specified in this section in a logbook (written or electronic format), as specified in § 63.11457(c).

(4) If the results of a required inspection indicate a problem with the operation of the emission control system, you must take immediate corrective action to return the control device to normal operation according to the equipment manufacturer's specifications or instructions.

(e) For each affected furnace that is subject to the emission limit specified in Table 1 to this subpart and can meet the applicable emission limit without the use of a control device, you must demonstrate continuous compliance by satisfying the applicable recordkeeping requirements specified in § 63.11457.

Notifications and Records

§ 63.11456 What are the notification requirements?

(a) If you own or operate an affected furnace, as defined in § 63.11449(a), you must submit an Initial Notification in accordance with § 63.9(b) and paragraphs (a)(1) and (2) of this section by the dates specified.

(1) As specified in § 63.9(b)(2), if you start up your affected source before December 26, 2007, you must submit an Initial Notification not later than April 24, 2008 or within 120 days after your affected source becomes subject to the standard.

(2) The Initial Notification must include the information specified in § 63.9(b)(2)(i) through (iv).

(b) You must submit a Notification of Compliance Status in accordance with § 63.9(h) and the requirements in paragraphs (b)(1) and (2) of this section.

(1) If you own or operate an affected furnace and are required to conduct a performance test, you must submit a Notification of Compliance Status, including the performance test results, before the close of business on the 60th day following the completion of the performance test, according to § 60.8 or § 63.10(d)(2).

(2) If you own or operate an affected furnace and satisfy the conditions specified in § 63.11452(a)(2) and are not required to conduct a performance test, you must submit a Notification of Compliance Status, including the results of the previous performance test, before the close of business on the compliance date specified in § 63.11450.

§ 63.11457 What are the recordkeeping requirements?

(a) You must keep the records specified in paragraphs (a)(1) through (8) of this section.

(1) A copy of any Initial Notification and Notification of Compliance Status that you submitted and all documentation supporting those notifications, according to the requirements in § 63.10(b)(2)(xiv).

(2) The records specified in § 63.10(b)(2) and (c)(1) through (13).

(3) The records required to show continuous compliance with each emission limit that applies to you, as specified in § 63.11455.

(4) For each affected source, records of production rate on a process throughput basis (either feed rate to the process unit or discharge rate from the process unit). The production data must include the amount (weight or weight percent) of each ingredient in the batch formulation, including all glass manufacturing metal HAP compounds.

(5) Records of maintenance activities and inspections performed on control devices as specified in §§ 63.11453(b) and 63.11455(d), according to paragraphs (a)(5)(i) through (v) of this section.

(i) The date, place, and time of inspections of control device ductwork, interior, and operation.

(ii) Person conducting the inspection.

(iii) Technique or method used to conduct the inspection.

(iv) Control device operating conditions during the time of the inspection.

(v) Results of the inspection and description of any corrective action taken.

(6) Records of all required monitoring data and supporting information including all calibration and maintenance records.

(7) For each bag leak detection system, the records specified in paragraphs (a)(7)(i) through (iii) of this section.

(i) Records of the bag leak detection system output;

(ii) Records of bag leak detection system adjustments, including the date and time of the adjustment, the initial bag leak detection system settings, and the final bag leak detection system settings; and

(iii) The date and time of all bag leak detection system alarms, the time that procedures to determine the cause of the alarm were initiated, the cause of the alarm, an explanation of the actions taken, the date and time the cause of the alarm was alleviated, and whether the alarm was alleviated within 3 hours of the alarm.

(8) Records of any approved alternative monitoring method(s) or test procedure(s).

(b) Your records must be in a form suitable and readily available for expeditious review, according to § 63.10(b)(1).

(c) You must record the results of each inspection and maintenance action in a logbook (written or electronic format). You must keep the logbook onsite and make the logbook available to the permitting authority upon request.

(d) As specified in § 63.10(b)(1), you must keep each record for a minimum of 5 years following the date of each occurrence, measurement, maintenance, corrective action, report, or record.

You must keep each record onsite for at least 2 years after the date of each occurrence, measurement, maintenance, corrective action, report, or record, according to § 63.10(b)(1). You may keep the records offsite for the remaining three years.

Other Requirements and Information

§ 63.11458 What General Provisions apply to this subpart?

You must satisfy the requirements of the General Provisions in 40 CFR part 63, subpart A, as specified in Table 2 to this subpart.

§ 63.11459 What definitions apply to this subpart?

Terms used in this subpart are defined in the Clean Air Act, in § 63.2, and in this section as follows:

Air pollution control device (APCD) means any equipment that reduces the quantity of a pollutant that is emitted to the air.

Continuous furnace means a glass manufacturing furnace that operates continuously except during periods of maintenance, malfunction, control device installation, reconstruction, or rebuilding.

Cullet means recycled glass that is mixed with raw materials and charged to a glass melting furnace to produce glass. Cullet is not considered to be a raw material for the purposes of this subpart.

Electrostatic precipitator (ESP) means an APCD that removes PM from an exhaust gas stream by applying an electrical charge to particles in the gas stream and collecting the charged particles on plates carrying the opposite electrical charge.

Fabric filter means an APCD used to capture PM by filtering a gas stream through filter media.

Furnace stack means a conduit or conveyance through which emissions from the furnace melter are released to the atmosphere.

Glass manufacturing metal HAP means an oxide or other compound of any of the following metals included in the list of urban HAP for the Integrated Urban Air Toxics Strategy and for which Glass Manufacturing was listed as an area source category: arsenic, cadmium, chromium, lead, manganese, and nickel.

Glass melting furnace means a unit comprising a refractory-lined vessel in which raw materials are charged and melted at high temperature to produce molten glass.

Identical furnaces means two or more furnaces that are identical in design, including manufacturer, dimensions, production capacity, charging method, operating temperature, fuel type, burner configuration, and exhaust system configuration and design.

Particulate matter (PM) means, for purposes of this subpart, emissions of PM that serve as a measure of filterable particulate emissions, as measured by Methods 5 or 17 (40 CFR part 60, appendices A–3 and A–6), and as a surrogate for glass manufacturing metal HAP compounds contained in the PM including, but not limited to, arsenic, cadmium, chromium, lead, manganese, and nickel.

Plant site means all contiguous or adjoining property that is under common control, including properties that are separated only by a road or other public right-of-way. Common control includes properties that are owned, leased, or operated by the same entity, parent entity, subsidiary, or any combination thereof.

Raw material means minerals, such as silica sand, limestone, and dolomite; inorganic chemical compounds, such as soda ash (sodium carbonate), salt cake (sodium sulfate), and potash (potassium carbonate); metal oxides and other metal-based compounds, such as lead oxide, chromium oxide, and sodium antimonate; metal ores, such as chromite and pyrolusite; and other substances that are intentionally added to a glass manufacturing batch and melted in a glass melting furnace to produce glass. Metals that are naturally-occurring trace constituents or contaminants of other substances are not considered to be raw materials. Cullet and material that is recovered from a furnace control device for recycling into the glass formulation are not considered to be raw materials for the purposes of this subpart.

Research and development process unit means a process unit whose purpose is to conduct research and development for new processes and products and is not engaged in the manufacture of products for commercial sale, except in a de minimis manner.

§ 63.11460 Who implements and enforces this subpart?

(a) This subpart can be implemented and enforced by the U.S. EPA, or a delegated authority such as your State, local, or tribal agency. If the U.S. EPA Administrator has delegated authority to your State, local, or tribal agency, then that agency has the authority to implement and enforce this subpart. You should contact your U.S. EPA Regional Office to find out if this subpart is delegated to your State, local, or tribal agency.

(b) In delegating implementation and enforcement authority of this subpart to a State, local, or tribal agency under 40 CFR part 63, subpart E, the authorities contained in paragraphs (b)(1) through (4) of this section are retained by the Administrator of the U.S. EPA and are not transferred to the State, local, or tribal agency.

(1) Approval of alternatives to the applicability requirements in §§ 63.11448 and 63.11449, the compliance date requirements in § 63.11450, and the emission limits specified in § 63.11451.

(2) Approval of a major change to test methods under § 63.7(e)(2)(ii) and (f) and as defined in § 63.90.

(3) Approval of major alternatives to monitoring under § 63.8(f) and as defined in § 63.90.

(4) Approval of major alternatives to recordkeeping under § 63.10(f) and as defined in § 63.90.

§ 63.11461 [Reserved]

Tables to Subpart SSSSSS of Part 63

As required in § 63.11451, you must comply with each emission limit that applies to you according to the following table:

TABLE 1 TO SUBPART SSSSSS OF PART 63—EMISSION LIMITS

For each. . .	You must meet one of the following emission limits. . .
1. New or existing glass melting furnace that produces glass at an annual rate of at least 45 Mg/yr (50 tpy) AND is charged with compounds of arsenic, cadmium, chromium, manganese, lead, or nickel as raw materials.	a. The 3-hour block average production-based PM mass emission rate must not exceed 0.1 gram per kilogram (g/kg) (0.2 pound per ton (lb/ton)) of glass produced; OR b. The 3-hour block average production-based metal HAP mass emission rate must not exceed 0.01 g/kg (0.02 lb/ton) of glass produced.

As stated in § 63.11458, you must comply with the requirements of the NESHAP General Provisions (40 CFR part 63, subpart A), as shown in the following table:

TABLE 2 TO SUBPART SSSSSS OF PART 63—APPLICABILITY OF GENERAL PROVISIONS TO SUBPART SSSSSS

Citation	Subject
§ 63.1(a), (b), (c)(1), (c)(2), (c)(5), (e)	Applicability.
§ 63.2	Definitions.
§ 63.3	Units and Abbreviations.
§ 63.4	Prohibited Activities.
§ 63.5	Construction/Reconstruction.
§ 63.6(a), (b)(1)–(b)(5), (b)(7), (c)(1), (c)(2), (c)(5), (e)(1), (f), (g), (i), (j)	Compliance with Standards and Maintenance Requirements.
§ 63.7	Performance Testing Requirements.
§ 63.8(a)(1), (a)(2), (b), (c)(1)–(c)(4), (c)(7)(i)(B), (c)(7)(ii), (c)(8), (d), (e)(1), (e)(4), (f).	Monitoring Requirements.
§ 63.9(a), (b)(1)(i)–(b)(2)(v), (b)(5), (c), (d), (h)–(j)	Notification Requirements.
§ 63.10(a), (b)(1), (b)(2)(i)–(b)(2)(xii)	Recordkeeping and Reporting Requirements.
§ 63.10(b)(2)(xiv), (c), (f)	Documentation for Initial Notification and Notification of Compliance Status.
§ 63.12	State Authority and Delegations.
§ 63.13	Addresses.
§ 63.14	Incorporations by Reference.
§ 63.15	Availability of Information.
§ 63.16	Performance Track Provisions.

■ 5. Part 63 is amended by adding subpart TTTTTT to read as follows:

Subpart TTTTTT—National Emission Standards for Hazardous Air Pollutants for Secondary Nonferrous Metals Processing Area Sources

What Is The Compliance Date?

- Existing Sources: December 28, 2009.
- New Sources: Upon initial startup.

What Are The Permitting Requirements?

- Affected facilities must obtain a Title V permit.

What Are The Impacts?

- Three glass plants are expected to have to add controls to comply with the rule.

What Records Are Required?

Reporting:

- Initial notification and notification of compliance status (may be combined), due 120 days after promulgation date
- Initial notification informs EPA that the facility is subject to the standards. Notification of compliance status provides certification of compliance with standards.
- No ongoing compliance reports to be required beyond Title V Requirements.

Recordkeeping:

- Records to include copies of notifications submitted to EPA, glass production data, and records of monitoring and inspections.
- Records to be maintained in a form suitable and readily available for expeditious review.

You can also contact your Regional EPA air toxics office at the following numbers:

Address	States	Website/ Phone Number
Region 1 1 Congress Street Suite 1100 Boston, MA 02114-2023	CT, MA, ME, NH, RI, VT	www.epa.gov/region1 (888) 372-7341 (617) 918-1650
Region 2 290 Broadway New York, NY 10007-1866	NJ, NY, PR, VI	www.epa.gov/region2 (212) 637-4023
Region 3 1650 Arch Street Philadelphia, PA 19103-2029	DE, MD, PA, VA, WV, DC	www.epa.gov/region3 (800) 241-1754 (215) 814-2196
Region 4 Atlanta Federal Center 61 Forsyth Street, SW Atlanta, GA 30303-8960	FL, NC, SC, KY, TN, GA, AL, MS	www.epa.gov/region4 (404) 562-9131
Region 5 77 West Jackson Blvd Chicago, IL 60604-3507	IL, IN, MI, WI, MN, OH	www.epa.gov/region5 (312) 353-3575 (312) 353-4145 (312) 886-3850
Region 6 1445 Ross Avenue Suite 1200 Dallas, TX 75202-2733	AR, LA, NM, OK, TX	www.epa.gov/region6 (800) 621-8431* 214-665-7171
Region 7 901 North Fifth Street Kansas City, KS 66101	IA, KS, MO, NE	www.epa.gov/region7 (800) 223-0425 (913) 551-7566
Region 8 1595 Wynkoop St. Denver, CO 80202-1129	CO, MT, ND, SD, UT, WY	www.epa.gov/region8 (800) 227-8917* (303) 312-6460
Region 9 75 Hawthorne Street San Francisco, CA 94105	CA, AZ, HI, NV, GU, AS, MP	www.epa.gov/region9 (415) 744-1197
Region 10 1200 Sixth Ave Seattle, WA 98101	AK, ID, WA, OR	www.epa.gov/region10 (800) 424-4372* (206) 553-2117

*For sources within the region only.

For More Information

Copies of the rule and other materials are located at :
www.epa.gov/ttn/atw/area/arearules.html

United States Environmental Protection Agency
December 2007
www.epa.gov/ttn/atw/eparules.html
Office of Air Quality Planning & Standards (EI 43-02)

EPA

Summary of Regulations Controlling Air Emissions for the

GLASS MANUFACTURING INDUSTRY

NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS NESHAP (SUBPART SSSSSS) FINAL RULE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

GLASS MANUFACTURING
(SUBPART SSSSSS)

What Is An Area Source?

- Any source that is not a major source. (A major source is a facility that emits, or has the potential to emit in the absence of controls, at least 10 tons per year (TPY) of individual hazardous air pollutants (HAP) or 25 TPY of combined HAP.)

Who Does This Rule Apply To?

- Facilities with glass manufacturing furnaces producing at least 50 tons of glass per year.

Who Is Subject To The Rule?

- Glass manufacturing plants with continuous furnaces that process urban HAP metals (As, Cd, Cr, Pb, Mn, Ni) as raw materials (not including trace materials in non-HAP raw materials such as sand).

What Am I Required To Do?

- All affected sources must meet one of two emissions limits. New and existing sources have different monitoring requirements.

The charts on the following pages explain, in detail, how all affected glass manufacturers can comply with the rule.

Initial testing requirement:

- One-time performance test on each furnace unless the furnace has been tested in the last 5 years and the previous test demonstrated compliance.

	Monitoring Requirements	
	Baghouse	ESP
Existing	Inlet temperature monitoring: record every 15 minutes and record every 8 hours	ESP monitoring of the secondary voltage and secondary electrical current to each field of the ESP; measure every 15 minutes and record every 8 hours
New	Leak detectors	Install CPMS to measure and record the secondary voltage and secondary current to each field of the ESP
All Sources	Annual inspections of furnace control devices	
All Sources	Can submit a request for alternative monitoring under §60.8 or §63.8(f)	

Emission Limits	
Pollutant	Emission Limit*
Particulate Matter	0.2 lb/ton (0.1 g/kg)
Combined Urban HAP (As, Cd, Cr, Pb, Mn, Ni)	0.02 lb/ton (0.01 g/kg)

* Pounds emitted per ton of glass produced.
(Grams emitted per kilogram of glass produced.)